University of Zurich[UZH]

Augmenting Computer-Mediated Communication Tools to Mitigate Language and Culture Barriers in Global Virtual Teams

Dissertation submitted to the Faculty of Business, Economics and Informatics of the University of Zurich

to obtain the degree of
Doktorin der Wissenschaften, Dr. sc.
(corresponds to Doctor of Science, PhD)

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The Faculty of Business, Economics and Informatics of the University of Zurich hereby authorizes the printing of this dissertation, without indicating an opinion of the views expressed in the work.

Zurich, October 25, 2017

Chairman of the Doctoral Board: Prof. Dr. Sven Seuken

Abstract

Globalization and technological advances have led to a dramatic cultural transformation in today's workplace. While a few decades ago, the challenges of intercultural communication were largely constrained within the expatriate population, in recent years, the formation of *global virtual teams* (GVTs) – geographically dispersed work groups who reside in different countries and who rely on Computer-Mediated Communication (CMC) (e.g. email, videoconference) – has becoming increasingly common. Yet, GVTs face two significant challenges that negatively impact team performance: language diversity and cultural diversity. This dissertation explores the augmentation of CMC tools (through the use of feedback interventions – technologies that provide feedback of team members' behaviors) – to mitigate such challenges. I make the following contributions.

To address the challenge of language diversity, I contribute a richer understanding of the *attributions* (inferences about the causes of behaviors) native and non-native speakers form about each other in CMC. I investigate a design approach by augmenting CMC tools with feedback interventions to elicit and mitigate attribution mismatches. Feedback included automated quantitative feedback of team members' behaviors, with members' subjective interpretations of that feedback – which was shared among the team. Findings indicate that providing only automated feedback (without subjective interpretations of that feedback) can be detrimental in teams whose members differ in linguistic fluency.

To address the challenge of cultural diversity, I contribute a richer understanding of the complex intercultural communication challenges GVT members experience in face-to-face and CMC. I propose a new avenue for design by drawing inspiration from two fields of related work: intercultural training technologies and feedback tools to support group work. In contrast to current intercultural training tools that take place in simulated environments (i.e. virtual avatars in game environments), I identify the opportunity to utilize the communication channels GVT members already use (i.e. CMC) to develop intercultural competence as members go about their daily workplace interactions. In contrast to current prescriptive

approaches that direct learners in taking "culturally-appropriate" actions, I build upon the feedback method I employed for language diversity - to prompt team members in reflection (a core component of intercultural competence) about their intercultural encounters. Experimental findings indicate promising outcomes of applying such feedback interventions to address the challenges of language and cultural diversity in GVTs.

Zusammenfassung

Globalisierung und technischer Fortschritt haben zu einer dramatischen kulturellen Veränderung des heutigen Arbeitsplatzes geführt. Vor ein oder zwei Jahrzehnten waren die Herausforderungen der interkulturellen Kommunikation grösstenteils auf Auswanderer begrenzt. In den letzten Jahren jedoch wurden *globale virtuelle Teams* (GVTs) – geographisch verteilte Arbeitsgruppen, die in verschiedenen Ländern leben und besonders abhängig von Computer-unterstützter Kommunikation (CMK) (z.B. Email, Videokonferenz) sind – zunehmend üblicher. Dennoch stehen GVTs zwei signifikanten Hindernisse gegenüber, die einen negativen Einfluss auf die Teamleistung haben können: Sprachenvielfalt und kulturelle Vielfalt. Diese Dissertation erforscht die Augmentation von CMK-Werkzeugen um diese Herausforderungen zu bewältigen. Insbesondere untersuche ich das Potential von Feedback-Eingriffen – Technologien, die Feedback zum Verhalten von Teammitgliedern geben – um diese Herausforderungen zu bewältigen. Ich leiste dabei die folgenden Forschungsbeiträge:

Um die Herausforderungen der Sprachenvielfalt zu adressieren, trage ich zu einem besseren Verständnis der *Attributtierung* (Rückschlüsse auf die Gründe für Verhalten) bei, die Muttersprachler und Nicht-Muttersprachler in CMK übereinander schliessen. Ich untersuche einen vielversprechenden Designansatz indem ich CMK Werkzeuge mit Feedback-Eingriffen ausstatte um Diskrepanzen zu eruieren und abzuschwächen. Feedback beinhaltet automatisiertes quantitatives Feedback zum Verhalten von Teammitgliedern, zusammen mit subjektiven Interpretationen des Feedbacks von Teammitgliedern – welches mit der Gruppe geteilt wurde. Erkenntnisse deuten darauf hin, dass ausschließlich automatisiertes Feedback (ohne subjektiven Interpretationen dieses Feedbacks) sich nachteilig auf Teams auswirken kann in denen sich die Sprachkompetenz sich stark unterscheidet.

Um die Herausforderungen der kulturellen Vielfalt zu adressieren, leiste ich einen Beitrag zu einem besseren Verständnis der komplexen interkulturellen Kommunikations-Herausforderungen, welche GVT-Mitglieder in CMK und persönlicher Kommunikation

erleben. Inspiriert durch interkulturelle Trainings-Technologien, schlage ich einen neuen Ansatz für das Design von CMK-Technologie vor, um interkulturelle Kompetenz- und Feedback-Werkzeuge zu entwickeln und dadurch Gruppenarbeit zu unterstützen. Im Gegensatz zu gegenwärtigen interkulturellen Trainingswerkzeugen (d.h. virtuelle Avatare in simulierten Spielumgebungen), identifiziere ich Möglichkeiten die von GVT-Mitgliedern bereits genutzten Kommunikationskanäle (d.h. CMK) zu verwenden um Teammitglieder darin zu unterstützen interkulturelle Kompetenzen aufzubauen. Im Gegensatz zu gegenwärtigen preskriptiven Ansätzen, welche Lernende dazu anleiten „kulturell passende" Aktionen auszuführen, baue ich auf die Feedback-Methode, die ich für die Sprachenvielfalt benutzt habe –Reflektionen der Teammitglieder über ihre interkulturellen Begegnungen zu erforschen (ein Kernbestandteil der interkulturellen Kompetenz). Experimentelle Erkenntnisse deuten auf vielversprechende Ergebnisse für das Anwenden dieser Feedback-Eingriffe um Herausforderungen kultureller Vielfalt in GVTs zu adressieren.

Publications

Materials, ideas, and figures from this dissertation have appeared previously in the following publications. After each reference, I note the chapters in which material is used.

Journal papers

He, H.A., Yamashita, N., Wacharamanotham, C., Schmid, J., Horn, A., Huang, E.M. 2017. Two sides to every story: Mitigating intercultural conflict through automated feedback and shared self-reflections in global virtual teams. In *PACM on Human-Computer Interaction,* 1, 2, 51 (November 2017), 21 pages. [Chapter 7 and Chapter 8]

Conference papers

He, H.A. and Huang, E.M., 2014. A qualitative study of workplace intercultural communication tensions in dyadic face-to-face and computer-mediated interactions. In *Proceedings of the 2014 conference on Designing interactive systems (DIS 2014)* (pp. 415-424). ACM. [Chapter 5 and Chapter 6]

He, H.A., Yamashita, N., Hautasaari, A., Cao, X. and Huang, E.M., 2017. Why Did They Do That?: Exploring Attribution Mismatches Between Native and Non-Native Speakers Using Videoconferencing. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW 2017)* (pp. 297-309). ACM. [Chapter 3 and Chapter 4]

Organized workshops

He, H.A., Memarovic, N., Sabiescu, A. and de Moor, A., 2015. CulTech2015: Cultural diversity and technology design. In *Proceedings of the 7th International Conference on Communities and Technologies (C&T 2015)* (pp. 153-156). ACM. [Chapter 5]

Relevant supervised theses

Toenz, A. 2015. Master's Thesis: Augmenting video conferencing tools to support intercultural communication. University of Zurich, Department of Informatics.

Schmid, J. 2017. Bachelor's Thesis: Communication challenges in distributed teams: Exploring different types of feedback for supporting distributed teams in email communication. University of Zurich, Department of Informatics. [Chapter 7 and Chapter 8]

Research Acknowledgments

The research presented in this dissertation would have been an impossible endeavor without the help of many amazing collaborators.

To my advisor Elaine Huang: I am forever grateful for the opportunity to come to Switzerland and do my PhD with you. Thank you for supporting the idea of HCI and culture from the very beginning, and for inspiring me with your insightful feedback and probing questions. I have learned an immeasurable amount from working together.

To my committee members, Susan Fussell and Katharina Reinecke: Thank you for your constructive feedback and questions - they point to so many exciting directions for future work! Katharina, thank you for our early discussions about 'quantifying culture'. While I never reached this ambitious goal, thank you for inspiring this idea seed.

To my collaborator Naomi Yamashita: It is difficult to put into words how deeply grateful I am for our friendship and collaboration. Thank you for all the ways you have patiently mentored and helped me along my PhD journey – I learned so much from you about experiment design, framing research questions, and writing papers. The research in this dissertation would not have come together if not for your creativity and ideas.

To my students. Jenny Schmid: It was a pleasure to work with you. Implementing and running a 60-person experiment would not have been possible without your hard work and dedication. Arthur Toenz: It was a joy to work with a student with so much curiosity and enthusiasm. Our discussions inspired many research directions in this dissertation.

To my collaborators. Ari Hautasaari and Xun Cao: Thank you you for your insights and feedback with experiment design and implementation. Chiho Imoto: Thank you for your help with conducting and transcribing the Japanese interviews. Chat Wacharamanotham: Your experience and contributions with quantitative analyses significantly strengthened this work. Andrea B. Horn: Your creativity and feedback was tremendously helpful. It was a pleasure to

work together. Jagoda Walny: Our discussions always sparked insight and a renewed excitement in the ideas in this thesis. I am forever grateful for the time, energy and help you so generously donated to me. Anthony Tang: Thank you for your guidance and thoughtful discussions on early iterations of this work.

To my labmates at ZPAC – Christian Remy, Sarah Mennicken, Gunnar Harboe, Nemanja Memarovic, Chat Wacharamanotham, Chai-Kai Yang: Thank you for the innumerable rounds of feedback and constructive critique of my work over the last five years. I've learned a lot from you all. Thank you for making me a better researcher.

To Adam Runions: Thank you for everything you taught me about research, collaboration, generating ideas, and framing of problems. You helped me move forward when I was feeling stuck and overwhelmed. I could not have completed this thesis without you.

Acknowledgments

Ah, the PhD. A five year bipolar roller-coaster of a journey. I want to thank my friends and family for their support, love, and encouragement through this adventure. Without you, I would have quit midway. Or gone mad. Or both. Thank you. You mean the world to me.

To my wonderful parents. Mom: You continually inspire me with your curiosity and desire to learn and grow. Dad: Your wisdom and gentle reminders always helped me see the bigger picture when I felt lost. Thank you both for setting a brave example for me and supporting me unconditionally from far away.

To Caryl and Peter. Carlie – you are my guru, mother, sister, and friend. It is impossible to convey how much gratitude I feel when I think of our friendship. Our talks always changed my perspective from 'this sucks' to 'what can I learn from this?' Peter – you are my hero. I'm in awe at your resilience in challenges and unexpected turns in life. I'm so grateful for our friendship and have learned much from the wonderful person you are.

To ZPAC: Thank you to Sarah Mennicken (for our lovely talks, walks and laughs), Christian Remy (for our amazing hikes and adventures), Gunnar Harboe (for our interesting conversations), Nemanja Memarovic (for the positive energy you brought to the group), Chat Wacharamanotham (for your feedback and support), and Chia-Kai Yang (for your friendship).

To the staff at the University of Zurich: Monika Lauber, Barbara Jost, Claudia Leibundgut, Beat Rageth, Nathan Labhart, Daniela Bärtschi, Enrico Solca. Thank you for your help in the last five years and making my life and work so much easier and enjoyable!

To my friends and family in Switzerland, Canada, China, and Japan for their friendship and encouragement during this thesis. Thank you to Iris Helming, Hossein Shafagh, Anwar Hithnawi, Kristin Truempy, Philip Stutz, Eya Ben Charrada, Naomi Yamashita, Chiho Imoto, Jagoda Walny, Marjorie Furtado, Anne Goering, Oscar Barajas, Neil Liske, Jennifer JeJe, Jana Johnson, Nathan Labhart, Nicolai Marquardt, Kristin Marquardt, the Theler family, Sarah

Ebling, Patrick Poullie, Laura Mascarell, Simon van Rekum, Anne-Lise Routier, and Daniel Kierzkowski, Teresa Bolen, Ramon Santos, Yoshida Suugo, Mariko Nakamura, Fumihiko Sagawa, and my family Hi, Tamara, Jasper, Corbin, DaYi, XinYi, LaoLao, LaoYe and NaiNai.

Finally, to my best friend and partner in life, Adam Runions. Ah, so many laughs and tears in this PhD. Thanks for loving me, and for your generosity, kindness and wisdom. Thanks also for never telling me what I wanted to hear but what I (begrudgingly) needed to hear. Though we're both far away from home, being together always felt like home.

Dedication:

To my grandparents, **李晨** and 陈浩

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List of Acronyms

CSCW	Computer-Supported Cooperative Work
HCI	Human-Computer Interaction
GVT	Global virtual team
CMC	Computer-Mediated Communication
NS	Native speaker
NNS	Non-native speaker
CQ	Cultural Intelligence
FTF	Face-to-face

Chapter 1. Introduction[1]

Globalization and technological advances have led to a dramatic cultural transformation in today's workplace. While a few decades ago, the challenges of intercultural communication were largely constrained within the expatriate population [Ng et al., 2012], in recent years, advances in telecommunication and information technologies are facilitating the formation of *global virtual teams* (GVTs) – geographically dispersed work groups who reside in different time zones and countries [Horwitz et al., 2006] and who rely heavily on Computer-Mediated Communication tools for collaboration [Cramton, 2002]. Yet, GVTs face two significant challenges that can negatively impact team performance: language diversity and cultural diversity.

This thesis explores the augmentation of Computer-Mediated Communication tools to mitigate challenges arising from language and cultural diversity in GVTs. Specifically, I investigate the potential of feedback interventions – technologies that provide feedback of team members' behaviors – to mitigate such challenges. In this chapter, I introduce the context and motivation behind my research. I first discuss the necessity and prevalence of GVTs in today's international workplace. I then present two obstacles faced by GVTs: language and cultural diversity. Next, I discuss my research scope and its focus within the domains of Human-Computer Interaction and Computer Supported Cooperative Work. I identify gaps in current literature with regards to technological support for the aforementioned obstacles. I use these gaps to motivate the research objectives I tackle in my dissertation. I summarize my contributions and conclude with an organizational overview of this thesis.

1.1 Background and motivation

Global virtual teams (GVTs) are teams whose members are distributed across geographical, cultural, linguistic, organizational and professional boundaries [Cramton, 2002]. GVTs often

[1] Portions of this chapter are also published in: He et al., 2014 (DIS 2014), He et al., 2017 (CSCW 2017), He et al. 2017 (PACM on Human-Computer Interaction).

have limited or no history of working together as a group, collaborate on short-term tasks, and rely heavily on Computer-Mediated Communication (CMC) tools [Cramton, 2002], such as email, audioconference, or videoconference for collaboration. GVTs enable organizations to compete in today's fast-paced economy by improving the utilization of scarce resources, accommodate technical requirements and constraints, and to carry out projects that involve multiple locations [Cramton & Webber, 2005; Daim et al., 2012]. The skills, talents, and other advantages from workers across the globe can be utilized [Dekker et al., 2008], while reducing travel expenses, travel time, and CO_2 emissions [Daim et al. 2012].

In recent years, GVTs have become increasingly commonplace [Soloman, 2001]. According to research by Gartner, Inc., 137 million workers worldwide will be involved in some form of remote electronic work by 2003 [Soloman, 2001]. By 2015, 75 percent of knowledge-based project work in the Global 2000[2] will be completed by GVTs [Light, 2011]. A survey of 376 business managers from different branches in Germany found 20% of managers worked predominantly as a virtual team member, while 40% of mangers worked temporarily in virtual teams [AFW, 2002]. Similar numbers have been reported for other countries [Hertel et al., 2005]. Yet, despite the growing prevalence of GVTs, two significant obstacles can negatively impact team performance: 1) disparities in the common language proficiency of team members, and 2) cultural diversity of team members.

1.1.1 Disparities in common language proficiency

> *"It's like walking through jelly. You could walk so much easier if you could talk in German. But it's this language which is holding you back."* – German informant at a global technology firm following an English-only language policy [Neeley et al., 2009]:

As cross-national workforce collaborations increase, so does the need for tightly coordinated work across diverse geographical regions [Feely & Harzing, 2003]. To facilitate collaboration,

[2] "Global 2000" refers to an annual ranking of the top 2000 public companies in the world by Forbes magazine, based on four metrics of sales, profit, assets and market value. https://www.forbes.com/global2000

the mandate of a common language (*lingua franca*) has become increasingly prevalent in global organizations [Feely & Harzing, 2003]. The goal is to sanction a mutually accessible language (in most cases, English) to unite a workforce whose members reside in different countries and who speak different native languages [Crstyal, 2003; Neeley, 2013; Henderson, 2005].

However, inherent in this one-language policy is the assumption that employees can and will seamlessly transition to the common language without consequence [Hinds et al., 2014; Neeley, 2013]. Yet, studies find that proficiency in the common language is a source of power and status in the workplace [Neeley, 2013], creating a linguistic divide between native speakers and non-native speakers. Disparities in the common language proficiency have been found to act as a "fault-line" dimension [Lau & Murnighan, 1998], leading to an "us versus them" dynamic [Hinds et al., 2014]. This imbalance has been found to interfere with trust and team building [Henderson, 2005], and contribute to ineffective communication [Harzing & Feely, 2008; Neeley et al., 2009], faulty attributions, conflict and distortion [Harzing & Feely, 2008], and a cycle of negative emotions that disrupt interpersonal relations and collaborative work [Neely et al., 2009].

1.1.2 Cultural diversity of team members

> *"We were all having dinner together in a restaurant. There were several Canadians, male and female, and one Tunisian female engineer. At one point, I made a joke about my Tunisian counterpart. I can't remember what I said, but I remember clearly that she threw an ashtray directly at my face; I had to duck to avoid it. Her intent was clearly to hit me. Afterwards I asked my female Canadian colleagues if they found my joke offensive – they did not think so, they couldn't understand her reaction either."* - Canadian engineer working in a multicultural team: [Laroche, 2003]

Another significant obstacle GVTs face is *cultural diversity* - the diversity of team members' cultural backgrounds [Laroche, 2003]. *Culture* is defined as "an accumulated pattern of values, beliefs, and behaviors shared by an identifiable group of people with a common history and a verbal and non-verbal symbol system" [Neuliep, 2000]. Though culture can be analyzed on several levels (e.g. national, regional, organizational) [Laroche, 2003], in this thesis, I focus on

national culture - the values, beliefs, norms and customs associated with the culture of a nation [Hofstede, 2001]. While no two individuals of the same national culture are identical, members of the same culture often share similar thinking and behavior patterns [Hofstede, 2001]. In this dissertation, I focus on national culture since it is a level of culture that has been significantly investigated in cultural anthropology and management literature with regards to its impacts on teams and in organizational life (e.g. [Hall, 1976; Leidner & Kayworth, 2006; Shachaf, 2008; Hofstede et al., 2010]).

In the workplace, cultural diversity in teams contributes to different communication, decision-making and collaboration styles [Laroche, 2003; Hofstede, 2001]. Such differences can be both an asset and a liability in organizations [Stahl et al., 2010]. On one hand, culturally diverse teams have the potential to outperform culturally homogeneous teams in problem solving, creativity, performance and less "groupthink" [Watson et al., 1993]. On the other hand, cultural diversity contributes to a lack of shared mental models, which increases the ambiguity and complexity of communication [Shachaf, 2008]. This can result in misunderstandings, which confirm prejudices, rather than breeding mutual understanding [Hofstede, 2001]. Compared to homogenous teams, culturally diverse teams have found to experience lower levels of trust and cohesion [Shin & Zhou, 2007], less effective communication [Nouri et al., 2013] and higher levels of interpersonal conflict [Hinds & Mortensen, 2005; Leung & Wang, 2015]. If cultural differences in communication are not understood or resolved, teams can function at a low level of effectiveness, failing to meet project goals and at times, leading to organizational failures [Laroche, 2007].

1.2 Research scope

This dissertation is situated within the fields of Computer-Supported Cooperative Work (CSCW) and Human-Computer Interaction (HCI). The field of CSCW investigates the behaviours and work patterns of groups, the effects of technologies on group work, and the design of technologies to support collaboration and group activities [Baecker, 1993; Greenberg, 1991]. HCI - a multi-disciplinary field with significant overlaps to CSCW - investigates the human factors of computing systems to understand how to design computational devices that are both usable and useful for individuals [Dix et al., 1998]. Within

these two fields, my focus is on the design of Computer-Mediated Communication tools to support global virtual team members in mitigating the workplace challenges of disparities in common language proficiency and cultural diversity. While Computer-Mediated Communication (CMC) can refer to "any form of exchange that requires the use of a computer" [Dietz-Uhler & Clark, 2001], for reasons of scope, I focus on traditional types of CMC including email, Instant Messaging, audioconference and videoconference. I do not explore more recent collaboration and project management tools, such as Slack[3], Trello[4], or Asana[5]. The primary audience for the work presented in this dissertation are CSCW and HCI researchers, Computer-Mediated Communication tool developers, and interaction designers.

I narrow my research focus to the workplace interactions of small distributed teams (2-3 people), who communicate and collaborate remotely using CMC. I investigate small teams for several reasons. First, small teams are frequently employed for collaboration tasks in organizational life, where formal and informal two-person teams (dyads) are one of the most common units for workplace tasks [Topi et al., 2002]. Second, small teams bring broader perspectives and a richer variety of skills to problem-solving tasks compared to a single person, but encounter fairly low process losses [Steiner, 1972]. Finally, small teams have simpler group dynamics compared to bigger teams [Forsyth, 2014], which allow me to better investigate the effects of proposed technology interventions and its impact on language and cultural diversity challenges.

1.3 Thesis problem

Despite the obstacles GVTs face with regards to disparities in common language proficiency and cultural diversity, to date, there is little technological support to aid GVTs in mitigating such challenges. In this dissertation, I explore the potential of leveraging Computer-Mediated

[3] Slack is a cloud-based set of team collaboration tools and services. https://slack.com

[4] Trello is a web-based project management application https://trello.com

[5] Anasa is a web and mobile application to help teams with task management. https://asana.com

Communication tools – communication channels GVT members already use - to alleviate these obstacles. I investigate the overarching thesis problem:

Thesis problem:	How can Computer-Mediated Communication tools support GVT members in mitigating the challenges of 1) disparities in common language proficiency and 2) cultural diversity?

Towards this overarching thesis problem, the next sections highlight gaps in existing CSCW literature with regards to technological support for each obstacle. Based on these gaps, I identify the research objectives I pursue in this dissertation. Objectives I and II examine challenges arising from disparities in common language proficiency. Objectives III, IV, and V examine challenges arising from cultural diversity.

1.3.1 Technological support for Challenge 1: Disparities in common language proficiency

Compared to native speakers (NS) of a common language, non-native speakers (NNS) experience a significantly higher cognitive load [Takano & Noda, 1993; Yamashita et al., 2013]. In conversations with NS, NNS are overwhelmed with multiple parallel processes including foreign language comprehension, foreign language production, and intensive thinking, which is typically accompanied by internal speech in their native language [Takano & Noda, 1993]. As a result, in multiparty conversations with majority NS, discussions can move forward rapidly while NNS are left behind [Yamashita et al., 2013]. In synchronous CMC such as audioconferencing, such challenges are only exacerbated due to imperfect audio conditions [Echenique et al., 2014, Yamashita et al., 2013].

The higher cognitive load NNS experience can impact their behavior in several ways. NNS may avoid interactions with NS as it may bring up negative emotions due to failure or perceived failure in such encounters [Neeley, 2013]. In multiparty conversations with majority NS, NNS have been found to manage their self-presentation by speaking less [MacIntyre et al., 1997; Yamashita et al., 2009], refraining from asking clarification questions [Harzing & Feely, 2008], and exhibiting more tense and apprehensive non-verbal behaviors [Gregersen, 2005].

In a recent study exploring NS-NNS interactions in face-to-face settings, findings suggest that NS may be unaware of the extent of language challenges faced by NNS and how such challenges can hinder interactions [Yuan et al., 2013]. This lack of awareness may impact the attributions NS-NNS form about each other, where *attribution* is defined as "the process by which people make inferences about the causes of events" [Cramton, 2002]. For example, if a NNS speaks very little during a meeting, NS may attribute their low level of participation due to dispositional (i.e. personality) traits (e.g. a lack of assertiveness or competency) rather than language barriers. Alternately, NNS may make inaccurate attributions about NS – e.g. if the NS dominates the conversation, that they are uncaring or insensitive to NNS' language difficulties. Since the attributions people make about others significantly impact how people perceive, evaluate, and treat them [Leary & Kowalski, 1990], attribution errors in the workplace can influence decisions about who to trust, doubt, defend, attack, hire, or fire [Cuddy et el., 2008] and can sometimes lead to unfortunate organizational consequences [Cuddy et al., 2011]. Remote team members may be particularly susceptible to making such errors, due to the reduced access to social and contextual cues in CMC [Cramton, 2002].

To address disparities in common language proficiency in distributed teams, researchers within the CSCW field have explored various means to alleviate the cognitive burden NNS experience (e.g. [Yamashita et al., 2013]), improve NNS comprehension (e.g. [Pan et al., 2009; Gao et al., 2014, Hautasaari & Yamashita, 2014]), and establish conversational grounding in multilingual conversations (e.g. [Wang et al., 2013, Yamashita et al., 2009, Echenique et al., 2014; Gao et al., 2015]). To date, the focus of this research has been to support NNS in improving comprehension and participation with NS in CMC. Yet, little is known about the attributions NS and NNS form about each other in computer-mediated interactions. Such an understanding is important in order to develop technological support tools to alleviate such challenges. This brings me to my first research objectives:

Objective I:	Expand our understanding of the attributions native speakers and non-native speakers form about each other in CMC.

Objective II:	Based on the above understanding, investigate the potential of CMC tools to support such attribution processes.

1.3.2 Technological support for Challenge 2: Cultural diversity

I now transition to another obstacle GVTs face: the cultural diversity of team members. I organize this section into two parts, representing two sequential phases of my research. Part 1 aims to gain a deeper understanding of the intercultural communication challenges GVTs experience in CMC. Part 2 explores the design and evaluation of CMC tools to mitigate intercultural communication challenges.

1.3.2.1. Understanding intercultural communication challenges in CMC

Cultural diversity in teams can lead to significant challenges in intercultural communication [Nouri et al., 2013], both in face-to-face settings (e.g. [Hall, 1976; Hofstede et al., 2001]) and in Computer-Mediated Communication (CMC) (e.g. [Shachaf, 2008; Leidner & Kayworth, 2006]). To better understand the challenges of intercultural communication in CMC, researchers have explored how national culture influences CMC usage. Examples include cultural differences in how people schedule events online [Reinecke et al., 2013], the use of task-focused versus relationship-focused messages in Instant Messaging conversations [Nguyen & Fussell, 2013], or culturally different perceptions in the importance of emoticons, multiparty chat and audio-video chat [Kayan et al., 2006]. Studies such as these demonstrate significant differences in CMC usage between people from diverse national cultures.

However, a few gaps remain in the literature. First, current studies focus either on face-to-face or on CMC, with only a handful of studies comparing face-to-face with a single type of CMC (e.g. Instant Messaging) (e.g. [Setlock et al., 2004]). Yet, face-to-face and CMC (e.g. email, Instant Messaging, videoconference) vary significantly in their "richness" and capacity to convey information cues [Daft, 1987]. For example, email – a "lean" asynchronous text-based medium - might afford different intercultural communication challenges compared to face-to-face – a "rich" medium that conveys contextual information and verbal and non-verbal cues. Thus, we do not know whether the intercultural communication challenges GVT members experience in face-to-face also appear in different types of CMC. The literature lacks

a broad understanding of how culture influences communication across a wide spectrum of media. Such an understanding is important in order to identify opportunities for technology support. From this perspective, I identify my next research objective:

Objective III:	Expand our understanding of the intercultural communication challenges GVT members experience in face-to-face and CMC media.

Second, while earlier media theories argued that CMC limits peoples' natural communication patterns due to reduced social presence and exchange of cues, more recent theories argue that "media are malleable", where given enough time and experience, CMC features can "enhance aspects of communication, instead of just restricting them" [Carte & Chidambaram, 2004]. Yet, the literature is sparse with regards to how (or if) professionals adapt when communicating with culturally diverse people over face-to-face and CMC media (for exceptions, see Anawati & Craig, 2006; Cramton & Hinds, 2014; Wang et al., 2009; Zakaria & Talib, 2011). Since some level of adaptation is required for successful intercultural interactions [Laroche, 2003], understanding how, if or when professionals adapt in different media is crucial to designing effective solutions to facilitate intercultural communication. From this perspective, I identify Research Objective IV:

Objective IV:	Expand our understanding of the adaptations culturally diverse professionals make in face-to-face and CMC media to mitigate intercultural communication challenges.

1.3.2.2. The design and evaluation of CMC **t**ools to mitigate intercultural communication challenges

The previous objective investigates intercultural communication challenges in face-to-face and CMC media. Yet, regardless of the medium for interaction, effective communication across cultures is not an innate skill, but rather a capability that must be honed through time and experience [Crowne, 2008]. One approach to speed this process is to support people in developing *intercultural competence* – the awareness, knowledge, and skills to interact with others from diverse national cultures [Hofstede, 2001]. Current technological approaches to

developing intercultural competence take place in simulated game environments, where users learn intercultural competence through interactions with culturally-realistic virtual agents or intelligent tutors (e.g. [Dusan et al., 2007; Endrass et al., 2010; Ogan et al., 2010; Raybourn & Waern, 2004]). Benefits include a safe environment for learners to explore complex intercultural situations without real-world consequences [Mascarenhas et al., 2010].

However, such approaches also have limitations. First, it is unclear how much learning effectively transfers from simulated environments to real-world contexts [Raybourn & Waern, 2004]. Second, training takes place prior to real-world interactions, requiring dedicated time and effort to complete. Third, current training approaches are prescriptive – that is, they direct users in taking "culturally-appropriate" actions, and are built upon computational models of "correct" or "incorrect" cultural behaviors. Yet, culture is a complex and ill-defined domain - there is a lack of consistent, unambiguous and generalizable solutions for "right" versus "wrong" behaviors [Lane et al, 2007]. Prescribing "culturally-appropriate" actions based on computational models might only serve to reinforce cultural stereotypes, rather than teaching learners a deeper and nuanced understanding of culture [Ogan et al., 2010].

To address the first and second limitations, I identify an opportunity for utilizing CMC tools (i.e. existing communication channels GVT members already use) to support distributed team members in developing intercultural competence. In contrast to previous approaches that focus on training prior to real-world interactions, I am interested in the augmentation of CMC tools to support remote members in developing intercultural competence as they go about their daily workplace interactions. To address the third limitation, rather than prescriptive approaches that direct learners in taking "culturally-appropriate" actions, I explore the design of CMC tools that prompt reflection about intercultural encounters. Such reflective capabilities are a crucial component of intercultural competence [Earley & Ang, 2003], referring to one's ability to be consciously aware of others' cultural preferences, to question one's own cultural assumptions and prejudices and to adjust one's own mental models during and after interactions [Brislin et al., 2006]. From this perspective, I identify my final research objective:

Objective V:	Explore the design and evaluation of CMC tools to support global virtual team members in developing intercultural competence – specifically, by prompting reflection about intercultural encounters.

1.4 Methodology

In this dissertation, I design and implement two technological prototypes to augment CMC. The first prototype augments videoconference to address disparities in common language proficiency (Chapter 4). The second prototype augments email to address challenges arising from cultural diversity (Chapter 8). Both prototypes provide feedback – that is, they automatically detect team members' behaviors (e.g. amount of words spoken during a videoconference) and provide automated quantitative feedback based on those behaviors. In contrast to previous feedback prototypes that provide only automated quantitative feedback to homogeneous teams (e.g. [DiMicco & Bender, 2007; Leshed et al., 2010]), I investigate the combination of providing [automated quantitative feedback] with [participants' subjective interpretations of that feedback]. I explore the impact of such feedback in culturally-diverse teams whose members do not share the same native language.

To evaluate the above prototypes, I conduct two laboratory experiments (Chapters 4 and 8). In each experiment, small distributed teams complete a series of collaborative decision-making or negotiation tasks over CMC, where after each task, teams are shown feedback of group members' behaviors detected during the task. I employ a combination of quantitative and qualitative methods for data collection and analysis, where findings are triangulated across different types of data. Quantitative methods are valuable for uncovering interaction effects of various factors, though are limited in explaining why observed phenomenon may have occurred [Eberts, 1994]. On the other hand, qualitative methods are naturally suited to explore participants' subjective experiences and to help explain why certain phenomenon (identified using quantitative methods) may have occurred [Maxwell, 2005]. My analysis uses widely accepted techniques for analyzing qualitative data including open coding [Corbin & Strauss, 2014] and affinity diagramming [Beyer & Holtzblatt et al., 1999]. The experiments in Chapters 4 and 8 employ a mixture of quantitative and qualitative data collection and analysis methods.

In Chapter 6, I present an exploratory qualitative study based on open-ended, semi-structured interview questions to investigate participants' subjective experiences of workplace communication challenges.

1.5 Research contributions

The overarching goal in this dissertation is to provide initial insights and explorations in the design of Computer-Mediated Communication tools to mitigate language and cultural diversity challenges in global virtual teams, and to direct future research in this field of study. This research contributes original ideas, methods and findings to CSCW and HCI. Below, I summarize my primary contributions which directly correspond with the research objectives. Following each contribution, I state the chapter in which this contribution is discussed.

1. A richer understanding of the attributions native and non-native speakers form about each other in CMC (Research Objective I). Findings from a mixed-method experiment revealed a significant mismatch between how NS attributed NNS' behaviors (compared with NNS' self-attributions), but no significant mismatch in how NNS attributed NS' behaviors (compared with NS' self-attributions). Details are discussed in Chapter 4.

2. A design approach for the augmentation of CMC tools to mitigate attribution mismatches (Research Objective II). Specifically I explored the use of feedback interventions – automated quantitative feedback of group members' behaviors, combined with members' subjective interpretations of that feedback, which was shared among the team. Feedback acted as a probe to elicit the attributions NS and NNS formed about each other, where the same automated feedback revealed different interpretations by NS versus NNS. Shared subjective interpretations acted as a meta-channel for communication and impression management, allowing team members to resolve attribution mismatches. In contrast to previous studies that found benefits of providing only automated quantitative feedback to homogeneous teams who speak the same native language (e.g. [DiMicco et al., 2004; Leshed et al., 2010]), my findings demonstrate that providing only automated quantitative feedback (without subjective interpretations of that feedback) can be detrimental in teams whose members differ in common language proficiency. Details are discussed in Chapter 4.

3. A richer understanding of the complex intercultural communication challenges GVT members experience in face-to-face and CMC workplace interactions, the impact of various media on such challenges, and the successful and unsuccessful behavioral adaptations members made to mitigate such challenges (Research Objectives III and IV). Before conducting this study, I anticipated that there would be a set of intercultural communication challenges that were unique to face-to-face, challenges that were unique to specific types of CMC, and a set that was common across all media. However, what emerged from the data is that the most frequently occurring intercultural communication challenges were common to across face-to-face and various CMC media, regardless of the medium used. While intercultural communication challenges unique to face-to-face and unique to CMC do exist, such challenges were not strongly represented in the dataset and therefore inconclusive. My findings confirmed, extended and contradicted previous work, while identifying new obstacles and opportunities for the design of technologies to alleviate workplace intercultural communication challenges. Details are discussed in Chapter 6.

4. The identification of a new avenue for design (Research Objective V). In contrast to previous technological approaches to developing intercultural competence (i.e. virtual avatars in simulated games), I identify the opportunity to utilize the communication channels GVT members already use in their daily workplace interactions (i.e. CMC) to support team members in developing intercultural competence. In contrast to previous prescriptive approaches that direct learners in taking "culturally-appropriate" actions, I build upon the feedback method used in Research Objective #2 to prompt team members in reflection (a core component of intercultural competence) of their intercultural encounters. Details are discussed in Chapter 7.

5. The deployment of two technology prototypes in laboratory settings to gain an understanding of how feedback impacts attributions between NS and NNS (Research Objective II), and how feedback impacts team members' development of intercultural competence (Research Objective V). Experimental findings indicate promising outcomes of applying this feedback method to address the challenges of language and cultural diversity in GVTs. Details are discussed in Chapters 4 and 8.

1.6 Dissertation overview

This dissertation is structured into three parts. Part 1 presents background on global virtual teams. Part 2 examines challenges arising from disparities in common language proficiency. Part 3 examines challenges arising from cultural diversity. For literary convenience, I present this dissertation as a sequential exploration of the research objectives, though in reality, research into each objective often overlapped with other objectives, where findings from previous studies informed later studies and methodologies.

PART 1: Background on global virtual teams

Chapter 2 provides the background and context of global virtual teams – what they are, why they are formed, the unique challenges they face and how this leads to a complex structure in which global virtual teams must operate. The work in this dissertation address two of the challenges discussed in Chapter 2 – language diversity and cultural diversity.

PART 2: Disparities in common language proficiency

Chapter 3 explores the challenge of language diversity in global virtual teams. This chapter presents background on disparities in common language proficiency in the workplace, and related work on computer-mediated support tools that aim to alleviate such challenges. Chapter 3 identifies a gap in current literature and proposes research questions towards Research Objectives I and II.

Chapter 4 presents an exploratory laboratory study to investigate the impact of a technology prototype on the attributions native and non-native speakers form about each other in CMC, and its opportunities for technology support. This chapter addresses Research Objectives I and II.

PART 3: Cultural diversity

Chapter 5 transitions topics to explore the challenge of cultural diversity in global virtual teams. Chapter 5 presents the background and related work on culture, intercultural communication and national culture dimensions. Following this, Chapter 5 presents related work in CSCW which explores the impact of national culture on computer-mediated

interactions. Chapter 5 identifies gaps in existing literature and proposes research questions towards Research Objectives III and IV.

Chapter 6 presents a formative qualitative study to better understand the intercultural communication challenges professionals experience in face-to-face and CMC workplace interactions and the adaptations professionals make to mitigate such challenges. This chapter addresses Research Objectives III and IV.

Chapter 7 explores a design approach to mitigate intercultural communication challenges in CMC interactions. Chapter 7 draws inspiration from related work in two research fields: 1) technologies for training intercultural competence, and 2) automated feedback tools to support group work. Chapter 7 identifies a gap in current approaches and proposes research questions and hypotheses towards Research Objective V.

Chapter 8 evaluates this new design approach through a technology prototype. This chapter investigates the impact of this prototype through a mixed-methods experiment with 30 distributed Japanese-Canadian dyads who completed a negotiation task over email. This chapter addresses Research Objective V.

Conclusion

Chapter 9 summarizes the contributions of the work presented in this dissertation, in light of my research objectives and research questions (as presented in individual chapters). I discuss lessons learned from this research and conclude with possible directions for future work.

Chapter 2. Global Virtual Teams

Globalization and technological advances are facilitating the formation of *global virtual teams* (GVTs) – teams whose members are distributed across diverse geographical, cultural, linguistic, organizational and professional boundaries [Cramton, 2002]. In recent years, GVTs have become increasingly commonplace [Soloman, 2001]. According to research by Gartner, Inc, "137 million workers worldwide will be involved in some form of remote electronic work by 2003" [Soloman, 2001]. A recent industry report predicted that in 2015, 75 percent of knowledge-based project work in the Global 2000[6] would be completed by GVTs [Light, 2011]. A survey of 376 business managers from different branches in Germany found that 20% of managers worked predominantly as a virtual team member, while 40% of mangers worked temporarily in virtual teams [AFW, 2002]. Similar numbers have been reported for other countries [Hertel et al., 2005].

In this chapter, we[7] provide the background and context of GVTs. We first present characteristics of GVTs – how they function and why they are formed. Next, we present four interrelated challenges that GVTs face including locational differences, situational invisibility, reliance on Computer-Mediated Communication tools, and team diversity. Throughout each section, we discuss how these challenges impact the attributions and impressions team members form of one another and its influence on organizational outcomes. Overall, this chapter introduces the complex structure and high cognitive demand under which GVTs must operate, setting the scene for work in later chapters.

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[6] "Global 2000" refers to an annual ranking of the top 2000 public companies in the world by Forbes magazine, based on four metrics of sales, profit, assets and market value. https://www.forbes.com/global2000

[7] I am deeply indebted to my collaborators for the work presented in this dissertation. The use of the plural "we" in Chapters 2 to 9 refer to myself and the co-authors and collaborators acknowledged in the "Research Acknowledgements" and "Publications" section of this dissertation.

2.1 Characteristics of GVTs

Similar to traditional teams, GVTs are groups of people with a common purpose or goal, who interact interdependently within a larger organizational setting [Galbraith, 1993; Lipnack & Stamps, 1997]. However, unlike traditional teams, GVTs include members who are geographically dispersed across different time-zones and countries [Maznevski & Chudoba, 2000], have limited opportunity for face-to-face interactions [Cramton & Webber, 2005] and rely heavily on Computer-Mediated Communication (e.g. email, Instant Messaging, audioconference, videoconference) for collaboration [Cramton, 2002]. GVT members can be evenly distributed across locations (e.g. one member per location), or members can be clustered at different locations (e.g. two in Berlin, three in Mumbai and eight in Beijing) [Cramton, 2002].

GVTs are typically cross-functional [Lurey & Raisinghani, 2001], consisting of people with complementary skills from diverse departments [Kossler & Prestridge, 1996]. Depending on dynamic changes in the global market, GVTs are typically brought together to collaborate on specific, short-term projects and are rapidly formed, changed, and dissolved [Daim et al., 2012]. In the 1990's, GVTs were almost unheard of. Yet, in today's international marketplace, GVTs are a critical component of multinational organizations – they integrate information, make decisions, and implement actions that are both highly complex and strategically important to the organization's global strategy [Davison & Ward, 1999; Maznevski & Chudoba, 2000]. GVTs are employed in various fields, such as research and development (R&D), problem solving task forces, customer services [Hertel et al., 2005], as well as in non-economic organizations such as the sciences [Finholt, 2003].

2.2 Challenges faced by GVTs

GVTs offer many benefits: they enable organizations to combine skills, talents, and other advantages from workers across the globe [Dekker et al., 2008], capitalizing on globalization and the potential of increased productivity promised by a cross-national workforce [Neeley, 2013]. GVTs improve the utilization of scarce resources, accommodate technical requirements, employees, customers, constraints and allow organizations to carry out projects

that involve multiple locations [Cramton & Webber, 2005, Daim et al., 2012], while reducing travel expenses, travel time, and CO_2 emissions [Daim et al. 2012].

Despite the many benefits however, GVTs face numerous challenges that significantly impact collaboration and performance, including: 1) locational differences, 2) situational invisibility, 3) reliance on Computer-Mediated Communication tools, and 4) team diversity. While these challenges are complex and interrelated, for simplicity, we discuss them separately below.

2.2.1 Challenge #1: Locational differences

GVTs collaborate across geographical boundaries and are subject to *locational differences* – differences in the physical location of each team member's workplace - such as exogenous events, environments, constraints and practices [Cramton et al., 2007]. Exogenous events include things such as local economic conditions or emergencies, such as a public transportation strike or power outage [Cramton & Hinds, 2004]. Environments and constraints encompasses differences such as traffic conditions, commuting distance to the office, the quality, accessibility and features of equipment, measurement processes and standards, competing responsibilities, or pressure from local supervisors and coworkers [Cramton & Hinds, 2004]. Practices encompass local holidays, customs, shop hours, and working hours, which vary from location to location [Cramton & Hinds, 2004]. For example, not all geographical regions are equal with regards to the reliability of electrical power [Riopelle et al., 2003]. GVT members in Switzerland with 24-hour dependable electricity may be unaware that in India, hydroelectricity is a primary source of power. Power losses can occur for hours or days with little advance notice during drought season. Sudden power outages can result in loss of work and the time-consuming task of recreating work when it electricity resumes. Even if all GVT members have identical equipment, team members living in other parts of the world may never experience such frequent outages and resulting frustrations, and may not understand the impact of a country's power infrastructure on their remote teammates' working rhythms.

The above locational differences contribute to a complex structure in which GVT members must operate [Cramton et al., 2007]. Distributed members may have different

information, assumptions, preferences and constraints depending on their local environment [Cramton & Hinds, 2004]. Information about multiple physical locations must be gathered, organized, integrated and updated [Cramton, 2002]. Interactions between subgroups must be communicated to the whole [Cramton, 2002]. When team membership encompasses different time zones, scheduling and coordination of work activities becomes increasingly challenging [Maznevski & Chudoba, 20000]. With each additional location of a remote team member, complexity increases, intensifying the cognitive load under which GVTs operate [Cramton, 2002].

2.2.2 Challenge #2: Situational invisibility

The challenges of locational differences are intensified by *situation invisibility* [Cramton et al., 2007] – the invisibility of remote team members' situations and contexts. In face-to-face collaboration, team members usually share an understanding of what is happening in the shared workspace [Poppe et al., 2017]. For example, people working together around the same physical table can tell what other members are looking at, what task they are currently performing, who they are talking to, what mood they might be in, or whether they agree with a decision that was just made – merely through peripheral awareness or taking a quick glance in their direction. Indeed, when collaborators are collocated, research shows that members have an "up-to-the-moment understanding" of each other's interactions in the shared workspace [Gutwin & Greenberg, 2002], enabling them to seamlessly integrate their actions with those of other collaborators [Poppe et al., 2017]. In distributed work teams, this type of shared understanding and awareness is difficult to achieve [Gutwin & Greenberg, 2002]. Due to geographic dispersion and the reliance on Computer-Mediated Communication tools, GVT members are unable to observe firsthand important locational differences of their collaborators and consequently lack an understanding of each other's contexts and situations [Cramton et al., 2007].

The absence (or incompleteness) of contextual information has been found to result in miscommunications, misattributions, and ethnocentrism within the team [Cramton, 2002]. Group members are likely to notice, but not fully understand, patterns of preferences and behavior of remote team members and how such behaviors may correlate with location

[Cramton & Hinds, 2004]. For example, while team members in Germany may notice differences in the working hours of their collaborators in Mexico, they may not understand how such differences are impacted by the family structure, local traffic conditions or the public transportation system in that country. As a result of incomplete contextual information, team members have been found to make harsh, and often inaccurate, attributions about the behaviors and intentions of remote team members [Cramton, 2002; Jones & Nisbett, 1971]. Team members tend to believe remote situations are similar to one's own, and forget situational differences about remote situations that have been already communicated to them [Cramton et al., 2007].

While the sharing of contextual information between GVT members has been found to mitigate the above challenges and increase members' abilities to adapt to and understand each other [Cramton & Hinds, 2004], studies find that GVT members often fail to communicate critical information about their local situations and constraints [Cramton et al., 2007]. The authors speculate this is because contextual information is tacit and dynamic, making it cumbersome, un-instinctive and time-consuming to explicitly share with remote team members [Cramton, 2002].

2.2.3 Challenge #3: Reliance on Computer-Mediated Communication tools

For many multinational organizations, face-to-face meetings between distributed team members is costly and unrealistic [Rosen et al., 2007; Storper & Venables, 2004]. Consequently, GVTs have little opportunity for face-to-face interactions, where members must rely primarily on the use of Computer-Mediated Communication (CMC) tools [Cramton, 2002]. Yet, compared to face-to-face interactions, CMC tools offer reduced access to social and contextual cues [Cramton & Webber, 2005]. For example, email - a "lean" asynchronous text-based medium does not convey a person's verbal and non-verbal behaviors, contextual or situational information, or the instantaneous feedback that a "rich" medium like face-to-face does.

Studies find that the restriction of social and contextual cues negatively impacts distributed teams in several ways. First, compared to teams who interact face-to-face, teams that rely on CMC have been found to have worse relational outcomes [Hinds & Bailey, 2003], including lower cohesion [Straus & McGrath, 1994], less group identity [Bouas & Arrow,

1996], lower trust, weaker interpersonal relationships, and more interpersonal conflict [Hinds & Bailey, 2003]. Second, teams that rely on CMC experience more difficulties with information transfer [Hinds & Bailey, 2003], including uneven distribution of information to all team members, difficulty extracting uniquely held information by remote team members [Hollingshead, 1996], miscommunications regarding the weight or importance of transmitted information [Cramton, 2002], and difficulty conveying contextual information (e.g. who is in the office, what they are doing, and what problems they are confronting) [Hinds & Bailey, 2003]. Third, teams that rely on CMC tools struggle more with coordination and collaboration [Hinds & Bailey, 2003], particularly when taking part in complex, interdependent tasks, such as decision-making or negotiation tasks with no objective "correct" answer [Straus & McGrath, 1994; Maznevski & Chudoba. 2000]. Such coordination challenges can be further exacerbated by technical issues in CMC such as time lags and synchronicity [Hinds & Bailey, 2003], leading to frustration and possible miscommunications [Cramton, 2002]. Finally, the restriction of social and contextual cues in CMC has been found to impact impression formation – a study by Storck & Sproull (1995) found that the impressions people formed of remote others was "different from and less positive than the impressions they form of face-to-face others, starting from an equal baseline". The authors suggest this phenomenon may be due to the availability and salience of information that face-to-face team members versus remote team members have of one another [Storck & Sproull, 1995].

2.2.4 Challenge #4: Team diversity

Finally, GVTs experience significant challenges with regards to the diversity of its team members. *Diversity* refers to differences between individuals on any attribute that may lead to the perception that another person is different from the self [Jackson, 1992; Triandis et al., 1994]. Diversity can refer to an infinite number of dimensions, such as age, gender, ethnicity, nationality, or language background. Such dimensions are typically organized into two categories: "surface-level" and "deep-level". *Surface-level diversity* encompasses observable or noticeable demographic characteristics [Jackson et al., 1995; Riordan, 2001], such as gender or styles of dress. *Deep-level diversity* refers to invisible underlying characteristics, such as attitudes, opinions, beliefs or values [Harrison et al., 1998; Jehn et al., 1999]. Unlike surface-level

diversity, deep-level diversity is not immediately visible but rather learned through sustained interactions with group members over time [Harrison et al., 1998; Jehn et al., 1999].

Diversity in teams is often described in organizational literature as a "double-edged sword". Compared to homogeneous teams, a diverse team possesses a broader range of ideas, knowledge and perspectives, contributing to enhanced problem-solving, creativity, innovation, and adaptability [Adler & Gundersen, 2007; Stahl et al., 2010]. On the other hand, the same broad perspectives within a team can contribute to significant obstacles in communication and coordination [Jehn et al., 1999; Jackson et al., 1995; Horwitz & Horwitz, 2007]. This can lead to conflict, dysfunctional team interactions and suboptimal performance [Laroche, 2003]. In this dissertation, we focus on two types of diversity that have been a primary focus in the organizational research - language and culture.

Language diversity: Language is typically classified as a type of surface-level diversity - a constantly accessible and overt cue reinforced during nearly every interaction [Hinds et al., 2014]. Language diversity in global teams has been found to interfere with trust and team building [Henderson, 2005]. In a study of German and Japanese multinational companies, language diversity contributed to inaccurate attributions of team members' behaviors, team conflict, and distortion in management teams who did not share the same mother tongue [Harzing & Feely, 2008]. Asymmetries in the common language proficiency among team members has been found to lead to subgroups and an "us versus them" dynamic [Hinds et al., 2014], contributing to a cycle of negative emotions that disrupt interpersonal relations and collaborative work [Neeley et al., 2009]. In Chapter 3, we provide further background on the challenges of language diversity in GVTs.

Cultural diversity: Language and culture are inextricably intertwined [Yuan et al., 2013; Hofstede, 2001]. Related to language diversity is cultural diversity, which can include both surface-level and deep-level diversity traits [Laroche, 2003]. Surface-level cultural diversity includes observable qualities such as styles of dress, the foods people eat, or cultural customs. Deep-level cultural diversity includes invisible characteristics, such as the internal values, beliefs, attitudes held by people of a national culture [Hofstede, 2001; House et al., 2004]. Since cultural values are programmed early in life [Hofstede, 2001], differences in deep-level

cultural diversity are often subconscious and outside awareness of the individual [Hall, 1976]. Thus, the sources of conflict within culturally diverse teams can be difficult to identify, and even more difficult to resolve [Kirchmeyer & Cohen, 1992]. In this dissertation, we focus on deep-level cultural diversity. Chapter 5 provides further background on the challenges of cultural diversity in teams.

2.2.5 The impact of cognitive load on impressions and attributions

The aforementioned challenges of locational differences, situational invisibility, reliance on Computer-Mediated Communication tools and team diversity significantly increases the complexity and cognitive load under which GVTs must operate [Cramton, 2002; Hinds & Bailey, 2003; Cramton & Hinds, 2004; Cramton & Webber, 2005]. There is substantial evidence that *cognitive load* – when a person's cognitive resources are tapped or engaged [Maher, 1995] – exacerbates the tendency to form biased impressions and make attribution errors [Gilbert & Hixon, 1991; Ford & Kruglanski, 1995; Cramton, 2002]. This can have dire consequences for distributed teams, who have limited opportunities to resolve attribution errors or manage impressions as they might in face-to-face settings. Since GVTs typically collaborate on short-term projects and have limited history as a working as a group [Daim et al., 2012], forming accurate initial impressions and attributions of team members may be particularly important to successful GVT functioning. Chapters 3 and 4 explore this issue.

2.3 Summary

This chapter provided the background and context of GVTs. We presented four interrelated challenges that GVTs encounter - locational differences, situational invisibility, reliance on Computer-Mediated Communication tools and team diversity. We discussed the impacts of those challenges on team members' cognitive load, impression formation and attribution. In this dissertation, we focus on the challenge of team diversity – specifically, language and cultural diversity. The next chapter explores obstacles arising from language diversity.

Chapter 3. Disparities in common language proficiency: Background and related work[8]

To collaborate across international borders, the mandate of a common language (*lingua franca*) has become increasingly prevalent in multinational organizations [Feely & Harzing, 2003]. Multilingualism – when verbal and written communications are generated in multiple languages – is now considered only adequate for inter-subsidiary interactions where employees have limited interdependent collaborations [Piekkari & Zander, 2005]. In most cases, English is the common language of choice in multinational organizations, as it is spoken by a billion people worldwide and enables entry into English-speaking markets [Crystal, 2003]. Yet, the transition to a common language mandate is often done without organization support [Marschan et al., 1997; Neeley, 2013]. Implicit in this decision is that employees can and will seamlessly transition to the common language without consequence [Hinds et al., 2014]. Studies show this is untrue. In this chapter, we present background on the linguistic divide between native and non-native speakers of a common language, with particular focus on the challenges experienced by non-native speakers. Next, we highlight related work on computer-mediated support tools to alleviate non-native speakers' challenges and to facilitate native and non-native speaker interactions. Finally, we conclude with gaps in related work and identify a research question to explore this gap.

3.1 The linguistic divide

Common language mandates inevitably expose a disparity in common language proficiency among team members, with the most prominent gap between native speakers (NS) and non-native speakers (NNS) of the common language [Neeley et al., 2009]. Yet, language is the

[8] Portions of this chapter are also published in: He, H.A., Yamashita, N., Hautasaari, A., Cao, X. and Huang, E.M., 2017. Why Did They Do That? Exploring Attribution Mismatches Between Native and Non-Native Speakers Using Videoconferencing. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW)* (pp. 297-309). ACM.

primary vehicle for human communication [Stryker & Statham, 1985], where proficiency in the common language is a source of power and status in the workplace [Neeley, 2013]. In a study of a French IT company after a recent common language mandate, NNS were found to experience self-perceived status loss regardless of their actual fluency level, where NNS in the company shared a common attitude of resentment and distrust towards their native speaking coworkers [Neeley, 2013]. Indeed, using one's native language is more socially and cognitively advantageous than foreign language use [Takano & Noda, 1993; Tange & Lauring, 2009]. The following sections explore this imbalance.

3.1.1 Non-native speakers and the costs of cognitive load

Compared to NS, NNS experience a significantly higher cognitive load when interacting in the common language [Takano & Noda, 1993]. NNS have limited linguistic resources in a foreign language (e.g. constrained vocabulary) and must engage in more complex communication strategies, such as rephrasing, simplifying or repeating previous utterances to bridge the gap between their intended message and their grasp of the foreign language [Dornyei & Scott, 1997]. In multiparty conversations with majority NS, NNS have difficulty generating their own messages while simultaneously following NS speech [Yamashita et al., 2013]. In such settings, studies find that discussions can move forward rapidly with NS dominating the conversation, while NNS are left behind [Yamashita et al., 2013]. In synchronous CMC (e.g. audioconference), such challenges are only exacerbated due to imperfect audio conditions (reverberations and extraneous noise), which limits NNS' ability to comprehend foreign speech [Echenique et al., 2014, Yamashita et. al, 2013]. If NNS try to compensate for missed information, their ability to think about current conversational content is likely to decline, which hinders their ability to respond [Takano & Noda, 1993].

The costs of cognitive load also impact NNS' willingness to communicate. Research finds that for NNS, engaging with NS may bring up negative emotions, such as anxiety, social discomfort, or embarrassment, due to failure or perceived failure during interactions [Neeley, 2013; MacIntyre et al., 1997; Yamashita et al., 2009]. In turn, NNS have been found to exhibit more tense and apprehensive non-verbal behaviors with interacting with NS, with regards to facial activity, eye contact, smiling, posture, and gestures [Gregersen, 2005]. Consequently,

studies show that NNS try to manage their self-presentation by speaking less [MacIntyre et al., 1997; Yamashita et al., 2009], avoid interrupting talk between NS [Rogerson-Revell, 2008], and use less backchannel responses and nodding to express acknowledgement when compared to NS [Echenique et al., 2014, Gunnery & Hall, 2014]. To avoid appearing as incompetent, NNS may not request clarification when needed [Harzing & Feely, 2008] and may refrain from asking clarification questions [Harzing & Feely, 2008]. In a study of a Danish firm with an English common language mandate, NNS reported the decision to not bring up "non-essential" topics during workplace interactions in English [Tange & Lauring, 2009].

Given the above challenges, studies find that NNS take more time to complete tasks, be dominated in meetings, and have less access to people and information important to their work. In one of the earliest studies of organizations that mandated English as a common language, Hilderbrandt (1973) found that NNS would feverishly rehearse their oral presentations in English before public presentations and invested significantly more time in preparing communication-related tasks, compared to their more fluent peers. Crystal (2003) argued that scientists and managers who are NNS will take longer to assimilate reports, have less time to carry out creative work, and will be at a disadvantage compared with NS colleagues - particularly in meetings that require informal conversation. In an in-class simulation of an international organization, Knapp (2003) found that NS dominated over NNS in terms of class contributions and participation. Such patterns have also been found in multiparty audioconferences where majority NS dominate the conversation over minority NNS [Yamashita et al., 2013]. Finally, in a multilingual academic environment, Yuan et al. (2013) found that NNS who were proficient in workplace-related language usage, struggled with and avoided informal (non-work related) conversations with NS, resulting in the formation of subgroups based on one's native language.

Research also indicates that NNS who are less proficient in the common language have reduced access to people and information needed to conduct their work. For example, Marschan-Piekkari et al. (1999) found that employees with advanced English proficiency at a Finnish company were often asked to be information intermediaries, exposing them to more extensive organizational and strategic data, compared to their less fluent colleagues. Park et al.

(1996) found that employees fluent in the common language reported feeling a greater sense of centrality within a multinational organization, compared to colleagues who were less fluent. In a study of nine multinational companies, Fixman (1989) reported that compared to their less fluent counterparts, employees proficient in the common language were able to develop social networks and participate in social chat in the workplace.

3.2 Computer-mediated support tools for NS-NNS interactions

To address disparities in common language proficiency within distributed teams, researchers have explored various computer-mediated support tools to alleviate NS' cognitive burden and to facilitate NS-NNS interactions. We present four areas of related work: listening comprehension, conversational grounding, turn-taking imbalances, and multilingual collaboration.

3.2.1 Listening comprehension

One area of research aims to alleviate the cognitive burden NNS experience through computer-mediated support tools for listening comprehension. Much of this work has focused on the use of text transcripts of audio or video conversations through the use of automated speech-to-text translation. For example, Pan et al. (2009) explored the effects of real-time transcripts on NNS' listening comprehension during a non-interactive audio and video feed. While text transcripts may be redundant for NS, results showed that transcripts helped NNS recover from missed information and cues by allowing them to view the conversation in a textual format. Gao et al. (2014) extended these findings in an interactive setting to generate automated text transcripts during a real-time audioconference meeting. Results show that while automated text transcripts increased NNS' comprehension, reading lengthy transcripts with speech-to-text errors also imposed a significant cognitive cost. Hautasaari & Yamashita (2014) explored the idea of automatically highlighting keywords in real-time text transcripts in combination with speeded-up audio, to help NNS catch up on missed conversation in audioconference. Results showed that NNS made use of the highlighted keywords to confirm

their understanding of the ongoing conversation, where both NS and NNS used highlighted keywords as visual reminders of the audio content. However, due to errors in automated text transcripts and automatic highlighting, some NNS found it distracting though indicated an overall promising response to the approach. Cao et al. (2016) explored the specific advantages and disadvantages of automated text transcripts on NNS listening comprehension, with regards to its costs on cognitive load. Results found that automated transcripts helped NNS with certain problems (e.g. recognizing words they already know), though errors and lack of punctuation in automated transcripts led to confusion and introduced new listening comprehension challenges. Eye tracking data also revealed that NNS did not have time to fully utilize the transcripts during the listening task. Finally, Pan et al. (2010) investigated how the quality (error rate) of automated text transcripts in audioconference impacts NNS comprehension and subjective evaluations. Results found that a 20% Word Error Rate was the maximum limit for transcripts to be perceived as acceptable and useful by NNS. NNS comprehension improved significantly when the Word Error Rate was 10%, compared to when participants received no transcripts.

3.2.2 Conversational grounding

Another direction researchers have explored is the use of computer-mediated support tools for aiding conversational grounding between NS and NNS. *Conversational grounding* is defined as "establishing mutual knowledge that messages have been understood as intended" [Clark, 1996]. Conversational grounding is crucial to successful interpersonal communication, but is difficult to achieve between NS and NNS [Gao et al., 2015]. Due to interacting in a foreign language, NNS take longer to process information and generate speech [Takano & Noda, 1993]. However, NS have few cues that inform them about the reason for NNS' delay [Li et al., 2005]. Consequently, NS may incorrectly assume that more information is required or fail to provide the information necessary to achieve conversational grounding [Gao et al., 2015]. In multiparty audioconferences, such problems are found to be exacerbated, due to a lack of visual and contextual cues [Yamashita et al., 2013].

To support conversational grounding between NS and NNS in CMC interactions, researchers have explored various methods to visualize the areas where NNS are struggling.

The idea is that such visualizations may motivate NS to adjust their speaking or writing behaviors, in turn improving NNS' comprehension and ability to contribute to the dialogue, as well as benefitting the overall quality of group communication [Gao et al., 2014]. For example, Gao et al. (2014) investigated the impact of showing automated transcripts to only NNS (private condition), or showing transcripts to both NS and NNS (public condition). In the public condition when transcripts were available to both NS and NNS, NS speech clarity increased and both NS and NNS perceived a higher quality of conversation, compared to the private condition when only NNS saw the transcripts. Gao et al. (2015) later extended this work to explore the additional impact of awareness displays – displays that provide awareness of other group members' behaviors. Gao et al. (2015) explored a series of general to detailed awareness displays, which provided differing levels of information about how NNS were making use of automated text transcripts and bilingual dictionaries. Results show that the detailed awareness display - which showed exactly where NNS was looking in the transcripts or what word NNS searched for in the dictionary - led to better conversational grounding, compared to the other conditions that provided less detailed awareness.

Researchers have also explored the impact of different communication channels to support conversational grounding. For example, Veinott et al. (1999) explored the effect of audio-only or audio-plus-video channels in a collaborative task with distributed NS-NS pairs and distributed NNS-NNS pairs who interacted in English. Results found that NS-NS pairs found no benefit from the additional video channel, whereas NNS-NNS pairs established common ground more effectively and had fewer miscommunications when using the audio-plus-video channels, compared to only audio. Echenique et al. (2014) explored the impact on conversational grounding between NS-NNS when supplementing audioconferences with video, compared to supplementing audioconferences with real-time text transcripts. Results found adding text-transcripts helped NNS retain and repair common ground between NS, while adding video led to a degradation of common ground in subsequent interactions. Overall, NNS perceived text transcripts, compared to video, as a useful supplementary feature for repairing common ground with NS.

3.2.3 Turn-taking imbalances

Another approach to support NS-NNS in computer-mediated interactions is to correct turn-taking imbalances (i.e. when NS dominate the conversation). For example, Yamashita et al. (2013) implemented a system that inserted silence gaps of 0.2 to 0.4 seconds during real-time multiparty audioconferencing with majority NS and minority NNS. Silence gaps were introduced only for NS, allowing NNS to listen to the NS' speech earlier than other NS (Figure 1). The goal was to alleviate the cognitive burden experienced by NNS by providing them with additional time to process incoming messages and contribute messages. Results found that the artificial delays had beneficial and detrimental effects for both NS and NNS.

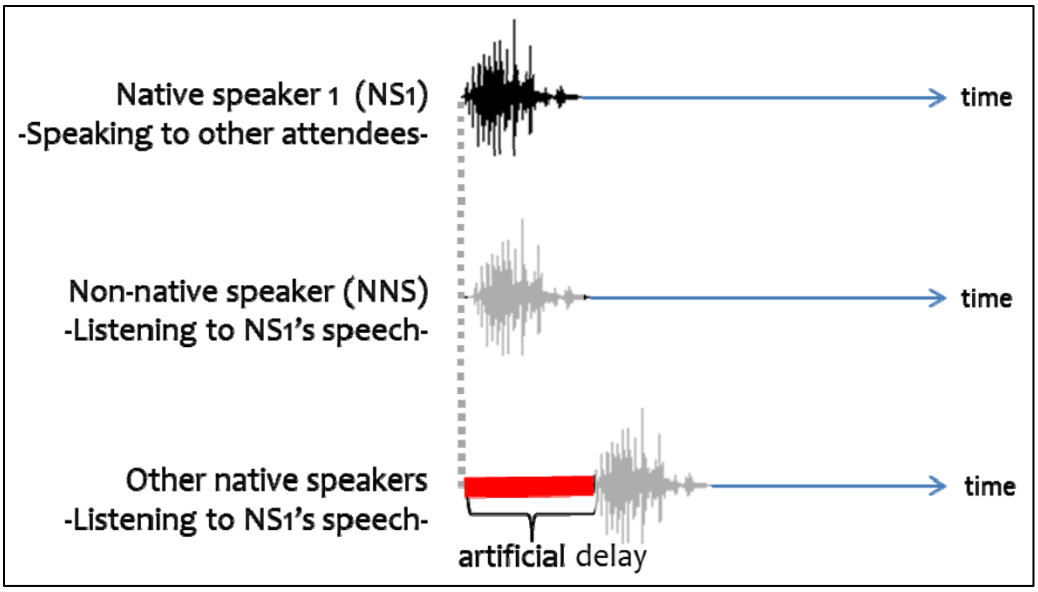


Figure 1. Yamashita et al. (2013)'s diagram illustrating insertion of silence gaps for native speakers, allowing non-native speakers in multiparty audio-conferences more time to process and contribute foreign speech.

Another example to mitigate turn-taking imbalances is the work of Li & Rosson (2014), who augmented an Instant Messaging chat system with an "annotation sidebar" where NS-NNS groups could annotate or comment on ongoing Instant Messaging discussions (Figure 2). The annotation sidebar was primarily intended for NNS as a second communication channel to compensate for disparities in common language proficiency. NNS who had access to the annotation sidebar reported feeling they could control the conversation more, compared to

NNS who did not have access to the sidebar. Both NS and NNS were found to multitask well between the main chat task and the annotations.

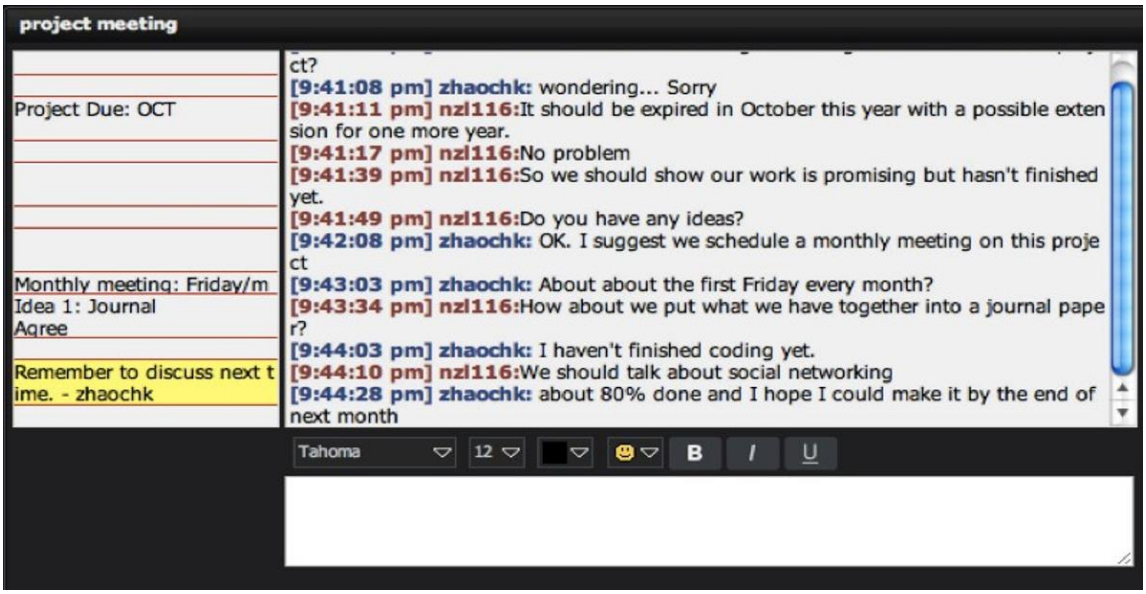


Figure 2. Li & Rosson (2014)'s Instant Messaging chat – the annotation sidebar is on the left, while the main conversation is on the right.

3.2.4 Multilingual collaboration

Another area of support tools to address the challenge of language diversity in teams are machine translation tools to enable multilingual collaboration. In contrast to previously mentioned tools that facilitate communication between NS and NNS of a common language, machine translation tools enable computer-mediated communication between people who speak different native languages. In recent years, machine translation tools have become increasingly commonplace (e.g. Google Translate[9], Bing Translator[10], Linguee[11]). The goal is to enable multilingual computer-mediated communication, allowing each person to both read and write in their native language [Yamashita & Ishida, 2006] (See Figure 3 for an example).

[9] translate.google.com/

[10] www.bing.com/translator

[11] www.linguee.com

By doing so, the aim is to avoid the cognitive load of interacting in a foreign language while freeing up those resources for the task at hand [Wang et al., 2013].

Figure 3. A machine translation interface allowing two people who speak different native languages (English and Chinese) to compose and receive messages in their native tongue [Wang et al., 2013].

While machine translation tools have made significant strides in recent years (e.g. see [Ishida, 2006; Shigenobu et al., 2007]), current tools still impose significant costs [Yamashita et al., 2009]. Problems include erroneous translations, unsuitable words for the communication context, or poor sentence compositions [Wang et al., 2013]. Such errors have been found to hamper communication and the establishment of mutual understanding and common ground [Yamashita & Ishida, 2006; Yamashita et al., 2009]. Such challenges are exacerbated in multiparty conversations (e.g. three person groups with one Chinese, one

Japanese and one Korean person), since translation errors across multiple language pairs make it challenging to track group members' understanding [Yamashita et al., 2009]. Researchers have explored various ways to improve upon current machine translation tools, such as highlighting keywords in machine-translated conversations [Gao et al., 2013], or having humans iterate upon machine translated output to improve translation quality [Tsai & Wang, 2015]. Overall, studies find that current machine translation tools offer benefits in producing messages in one's native language, though due to translation accuracy, suffers in comprehending messages translated from foreign speech [Wang et al., 2013].

3.3 A gap in related work: Attributions in GVTs

To date, computer-mediated support tools for NS-NNS interactions have primarily focused on supporting NNS in improving comprehension and participation with NS in CMC. Yet, previous research of NS-NNS interactions suggests that in face-to-face settings, NS may be unaware of the extent of language challenges faced by NNS and how such challenges can hinder interactions [Yuan et al., 2013]. Consequently, NS-NNS may form inaccurate attributions of each other's behaviors, where *attribution* is defined as "the process by which people make inferences about the causes of events" [Cramton, 2002]. For example, if a NNS speaks very little during a meeting, NS may attribute their low level of participation due to dispositional or personality factors (e.g. lack of assertiveness or competency) rather than language barriers. Alternately, NNS may make inaccurate attributions about NS – e.g. if the NS dominates the conversation, that they are uncaring or insensitive to NNS' language difficulties.

Yet, the attributions people make about others significantly affect people's subsequent feelings, thoughts and behaviors towards them [Cramton, 2002; Cuddy et al., 2011]. In the workplace, attributions impact a myriad of organizational outcomes such as evaluations of performance [Feldman, 1981], the allocation of credit or blame [Feldman, 1981], decisions on who to trust, doubt, defend, attack or hire [Cuddy et al., 2011] and team cohesion [Brawley et al., 1987]. Thus, the ability to form accurate attributions about others is crucial to effective decision-making in the workplace [Cuddy et al., 2011].

However, the attributions people make about others can often be inaccurate. When motivation is low, information is scarce, or cognitive capacity is strained, people rely on a minimally sufficient amount of cues to form a judgment of others [Cuddy et al., 2011]. In such cases, people tend to overweight dispositional factors (personality traits) over situational factors when attributing others' behaviors, known as the *fundamental attribution error* [Heider, 2013]. For example, if a colleague is late to an important meeting, observers may conclude he is disorganized or careless (dispositional), while the colleague may attribute his own lateness to a family emergency (situational). This happens because the actor typically has more information concerning the situation and the way it affected their behavior compared to observers [Jones & Nisbett, 1971].

While the fundamental attribution error can occur in collocated teams, studies show it is exacerbated in distributed teams [Cramton, 2002; Cramton & Orvis, 2002]. Distributed teams experience a higher cognitive load due to challenges arising from locational differences [Cramton, 2001], situational invisibility [Cramton et al., 2007], the reduced access to social and contextual cues in CMC [Hinds & Bailey, 2003; Cramton & Hinds, 2004] and team diversity [Laroche, 2003; Adler & Gundersen, 2007]. NNS of a common language experience the additional cognitive burden of communicating in a foreign language [Takano & Noda, 1993]. Yet, there is substantial evidence that cognitive load exacerbates the tendency to make the fundamental attribution error and form biased impressions [Gilbert & Hixon, 1991; Ford & Kruglanski, 1995; Cramton, 2002]. Such errors can have dire consequences for GVTs, who typically have limited experience working as a team, collaborate on short-term projects [Daim et al., 2012], and have little opportunities to meet face-to-face [Cramton & Webber, 2005] to resolve attribution inaccuracies.

Despite the importance of attributions, little research has explored the attributions NS and NNS form about each other in CMC. While previous research has investigated impressions (a more generalized form of attributions [McMahan, 1976]) in the context of social networking sites (e.g. [Kim & Ahn, 2013; Rosenberg & Egbert, 2011; Schoenebeck et al., 2016]), peer production sites (e.g. [Marlow & Dabbish, 2013, Marlow & Dabbish, 2015]), and online dating sites (e.g. [Zytko et al., 2014, Birnholtz et al., 2014]), such studies investigated

monolingual groups whose members share the same native language. Additionally, such studies focused on asynchronous, rather than synchronous CMC interactions. Based on these gaps, we identify the following research question towards Research Objective I:

Research question #1:	What attributions do native speakers and non-native speakers form about each other in a multiparty videoconference with majority native speakers?

We focus on videoconference for two reasons. First, videoconference is one of the preferred CMC media by NNS, since it is a "richer" medium (compared to text-based email communication or audioconference) where the synchronous transmittance of verbal and non-verbal cues can aid NNS in language comprehension [Echenique et al., 2014]. Second, since NNS often exhibit more tense and apprehensive nonverbal behaviors when speaking with NS [Gregersen, 2005], we are interested in the attributions NS and NNS form about each other when such non-verbal cues are conveyed. We choose this setup of majority NS and minority NNS, since NNS are often dominated in multiparty conversations with majority NS [Yamashita et al., 2013, Neeley et al., 2009]. We wish to evoke this scenario in our research since we believe NS and NNS may form different attributions of each other in this context. The next chapter presents an experiment to address this research question.

3.4 Summary

In this chapter, we presented background on the linguistic divide between native and non-native speakers of a common language. We focused in particular on the costs of cognitive load experienced by non-native speakers. Following this, we highlighted related work on computer-mediated support tools to alleviate non-native speakers' challenges, including tools for listening comprehension, conversational grounding, turn-taking imbalances and multilingual collaboration. Based on this related work, we identified a gap in current literature with regards to attributions between NS and NNS in computer-mediated interactions. The next chapter presents an experiment to address this gap.

Chapter 4. Exploring attributions between native and non-native speakers in multiparty videoconference[12]

This chapter presents a mixed-methods experiment to address ***Research Question #1: What attributions do native speakers and non-native speakers form about each other in a multiparty videoconference with majority native speakers?*** To investigate this question, we conducted an exploratory laboratory study with 16 groups (each group with 2 NS and 1 NNS) to investigate the attributions NS and NNS form about each other during videoconferencing. Each group completed a series of collaborative tasks, where during each task, a 3D camera detected participants' verbal and non-verbal behaviors. After the task, participants were shown a graph of the detected behaviors of all group members, and asked to write a self-reflection questionnaire to explain their own graph data, which was then shared with other group members. The graph and self-reflection questionnaire was used as a probe to elicit NS and NNS impressions and attributions of one another during the collaborative tasks. To better investigate Research Question #1, we split this question into four sub-questions:

- ***Sub-question #1a:*** What attributions did NS/NNS make to understand their own graph data?
- ***Sub-question #1b:*** Did mismatches occur between how NS/NNS attributed their own graph data versus how others attributed their data?
- ***Sub-question #1c:*** What function (if any) did writing and sharing the self-reflection questionnaire about one's own graph data serve for NS and NNS?

[12] Portions of this chapter are also published in: He, H.A., Yamashita, N., Hautasaari, A., Cao, X. and Huang, E.M., 2017. Why Did They Do That? Exploring Attribution Mismatches Between Native and Non-Native Speakers Using Videoconferencing. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW)* (pp. 297-309). ACM.

- ***Sub-question #1d:*** What influence (if any) did reading other group members' self-reflection questionnaires have for NS and NNS?

Our findings show that the graph and shared self-reflection questionnaire acted as an effective probe to elicit impressions and attributions between NS and NNS. Results revealed a significant mismatch between how NS attributed NNS' graph data, but no significant mismatch in how NNS attributed NS' graph data. Due to cognitive overload stemming from language challenges, NNS were only able to engage in a form of "compromised" impression management during the task. Yet, NS were relatively unaware of how profoundly language barriers impacted NNS' verbal and nonverbal behaviors. Our findings identify opportunities for the design of CMC technologies to support NS-NNS interactions, particularly in the domain of impression construction and impression management. In this chapter, we present the methodology and findings from this study. We discuss opportunities for technology support and conclude with future work and a summary of the chapter.

4.1 Methodology

We conducted an exploratory laboratory study with 16 groups (each group with two NS and one NNS). We chose this setup of majority NS and minority NNS, since NNS are often dominated in multiparty conversations with majority NS [Yamashita et al., 2013, Neeley et al., 2009]. We wished to evoke this scenario in the current study since we believed NS and NNS may form different attributions and impressions of each other in this context. A triad (two NS and one NNS) represent the minimum unit of multiparty interactions to evoke this pattern. Supplementary materials regarding Methodology are presented in Appendix A of this dissertation.

4.1.1 Participants

The study was advertised to participants as an exploration of "group dynamics over videoconferencing", where they would be "collaborating with two other people on a decision-making task over videoconferencing". We recruited 48 participants: 32 NS (12 female, 20 male) and 16 NNS (6 female, 10 male). NNS included 11 Japanese and 5 Chinese participants. NS

in three out of sixteen groups knew each other to some capacity before the study, while none of the NNS knew any NS in any group. The mean age for NS participants is 30.34 (SD=6.25), and for NNS participants is 24.75 (SD=2.41). None of the NNS participants lived in an English-speaking country for more than one year. NNS rated their fluency as medium (14 NNS) or low (2 NNS) (M=3.62, SD=1.02 on a Likert scale of 1=not fluent at all, 7=very fluent). We did not recruit NNS with high English fluency, since we wished to evoke attributions related to discrepancies in linguistic fluency. NS came from a variety of birth countries (e.g. United States, England), and recruited if their native language is English.

4.1.2 Setup

Upon arrival, participants were led into separate rooms located on the same floor. Instructions for the study were then given over Skype audio. All task documents were in English. NNS were provided an additional document containing task translations of possible unknown vocabulary, and the opportunity to ask clarifying questions in their native language to the interviewer in the room. During group discussions, participants collaborated over 3-way Skype videoconferencing, where each participant's behaviors were detected by a 3D camera. Video and audio data was recorded from a screen capture program and a camcorder located behind each participant.

4.1.3 Experiment procedure

Each experiment lasted approximately 2 hours. During this time, participants completed three collaborative decision-making tasks over 3-way videoconference, where during each videoconference, participants' verbal and nonverbal behaviors were detected by a 3D camera. We introduce the experiment procedure in Figure 4. The combination of graph data, the self-reflection questionnaire, and the other-reflection questionnaire were meant as probes to elicit NS-NNS impressions and attributions of one another during Trial 1. The semi-structured interview aimed to investigate how the graph, the self-reflection and other-reflection questionnaire influenced NS-NNS impressions and attributions of one another in Trial 2. In the following, we describe the main components below.

1. **Introduction** and instructions
2. **Training trial:** Collaborative decision-making (Task I)
3. **Trial 1:** Collaborative decision-making (Task II/III)
4. **View graph** (from Trial 1) of detected verbal and nonverbal behaviors of all group members
5. **Write self-reflection** questionnaire about own graph data (Shared)
6. **Write other-reflection** questionnaire about other group members' graph data (Private)
7. **Read** other group members' self-reflection questionnaires
8. **Trial 2**: Collaborative decision-making (Task III/II)
9. **Semi-structured interview**

Figure 4. Experiment procedure.

4.1.3.1. Collaborative Decision-Making: Survival Task Series

For a discussion topic, we chose the desert survival task series[13]. The survival tasks are often used in organizations to encourage team cohesion during initial team formation. We use this task series (steps 2, 3, 8 above) to mimic a workplace situation where distributed team members (two NS and one NNS) form impressions and attributions about one another in synchronous CMC.

Participants collaborated on modified versions of three survival tasks in different environments: desert, ocean and lunar. The goal is to rank salvaged items from most to least important for group survival. For each task, participants first ranked the items individually, and then discussed the rankings over videoconferencing to decide on a group ranking. Example items included a "cosmetic mirror" (desert), "opaque plastic sheeting" (ocean), and an "FM Receiver" (lunar). The desert task was used for training, to familiarize participants with the task, with each other and with videoconferencing as a communication channel. The ocean and lunar tasks were counterbalanced.

[13] Human Synergistics Company. http://www.humansynergistics.com/

4.1.3.2. Graph of Detected Verbal and Nonverbal Behaviors

To elicit NS-NNS impressions and attributions of each other, we detected four simple measures of verbal and nonverbal behaviors that are 1) important cues that inform impressions and attributions [McMahan, 1976], 2) might show up differently for NS and NNS during group discussions, based on related work and our previous experimental data of NS-NNS conversations (e.g. [Echenique et al., 2014, Yamashita et al., 2013]), and 3) easy to automatically detect in real-time. Detected verbal behaviors included the amount of words and the amount of verbal acknowledgements (e.g. "yeah", "ok", "uh-huh"). Detected nonverbal behaviors included the amount of time looking at others and the amount of time smiling. Graph data for verbal behaviors were calculated as ratios to total amount of verbal behaviors (i.e. amount of words / total amount of words) within the group, whereas graph data for nonverbal behaviors were calculated as ratios to total interaction time (i.e. time smiling / total interaction time).

We detected "amount of words" since it is an indicator of speech fluency, which is the strongest predictor of perceived competence, credibility, persuasiveness [Burgoon et al., 1990], dominance and status [Jayagopi et al., 2008]. Since NS have higher speech fluency than NNS, "amount of words" may reveal differing interpretations by NS and NNS. We detected "amount of verbal acknowledgments" since auditory backchannel responses can express agreement [Rosenfeld & Hancks, 1980]. However, compared to NS, NNS use fewer backchannel responses to express acknowledgment [DiMicco et al., 2006], which may contribute to differing interpretations by NS and NNS. We detected "time looking at others" since speakers who engage in eye contact are perceived as more trustworthy and confident than those who continually avert their gaze [Hemsley & Doob, 1978]. Since NNS may limit eye contact when processing or communicating foreign speech [Gregersen, 2005], this measure may elicit differing interpretations. Finally, we detected "time smiling" due to its associations with higher persuasiveness [Gunnery & Hall, 2014]. NNS who are cognitively overloaded may smile less [Gregersen, 2005], potentially impacting the attributions NS form of them. The above four measures are by no means exhaustive - rather, they represent a sampling of behavioral cues, which we believed might elicit different attributions by NS and NNS.

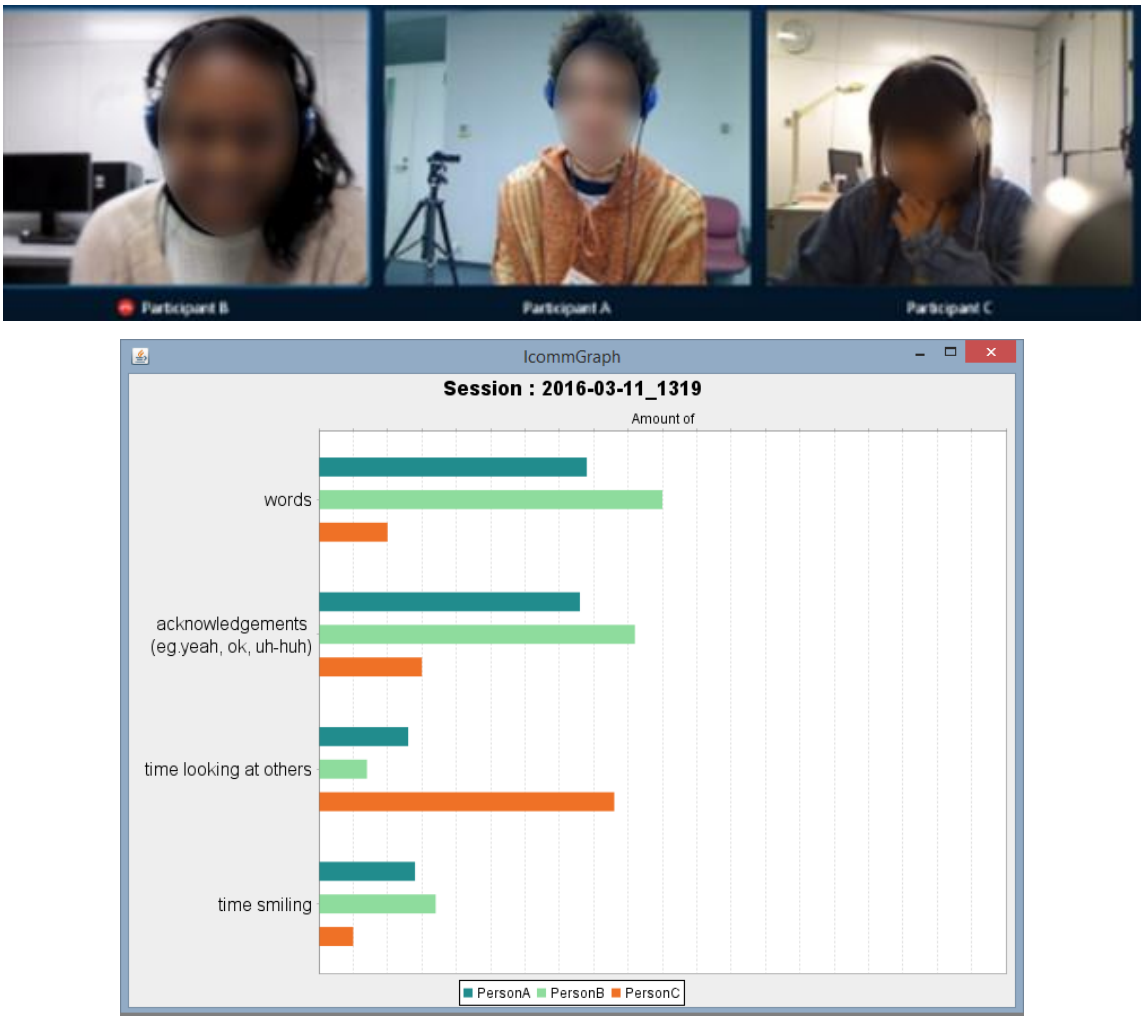


Figure 5. (Top): A screenshot of Experiment Group 7 showing three distributed team members (two native speakers and one non-native speaker), doing a collaboration task over 3-way videoconference. (Bottom): Example of automated quantitative feedback as shown to participants. Person A and Person B represent the native speakers, Person C represents the non-native speaker.

To detect these behaviors, we used the Intel RealSense front-facing 3D camera[14], which we mounted on top of each participant's laptop. During introductions (step 1), participants were told that a 3D camera will detect their verbal and nonverbal behaviors during the videoconference and they will be shown this data later in the study. After Trial 1's group

[14] Intel RealSense camera: https://software.intel.com/en-us/realsense/sr300camera

discussion, each remote participant was shown a simple bar graph (step 4), which visualized the detected behaviors of all group members (Figure 5).

4.1.3.3. Self-reflection and Other-Reflection Questionnaires

Writing the self-reflection questionnaire (shared): After seeing the graph, participants were asked to reflect upon their own graph data in a questionnaire, which they were told would be shared with other group members (step 5 in Figure 4). Instructions were to "Please discuss your OWN behavior based on the graphs" in an open-ended text-field. Each of the four detected behaviors provided an example prompt, such as "E.g. I talked the most/the least because…" or "E.g. I smiled the most/the least because…"

Writing the other-reflection questionnaire (private): Next, participants were asked to write reflections of other group members' graph data with the knowledge that their responses would not be shared (step 6 in Figure 4). Questions were similar to the self-reflection, except asked about other members (e.g. "Person B talked the most/least because…").

Reading others members' self-reflection questionnaire: Next, the two NS were shown the self-reflection questionnaire of the NNS, while the NNS read the self-reflection questionnaires of NS1 and NS2 (step 7 in Figure 4). Since this current study focuses on attribution misjudgments resulting from a disparity in linguistic fluency, NS were not shown each other's self-reflection questionnaires. Finally, we chose to only share participant reflections of their own graph data, since we felt participants may be uncomfortable sharing their reflections of other group members' data.

4.1.3.4. Semi-structured Interviews

After Trial 2, we conducted semi-structured interviews (step 9 in Figure 4), which lasted between 15 to 35 minutes. Participants were interviewed individually, where NS were interviewed in English and NNS in their native language (Japanese or Chinese). All interviewers followed the same protocol, which explored themes such as: impressions of the graph, attributions of the four graph measures for self and other group members, comparisons of impressions and attributions between Trial 1 and Trial 2, perceived usefulness of feedback and other topics that emerged.

4.1.4 Data Analysis

4.1.4.1. Semi-structured interviews

All interviews were partially transcribed. Using inductive qualitative methods [Corbin & Strauss, 2014], all participant quotes were then arranged into an affinity diagram by the first author, where high-level themes and relationships between the themes were inductively generated. Next, all researchers involved in this project collaboratively discussed the high-level themes to iteratively refine the codes. The findings below emerged from this collaborative analysis.

Self-reflection and other-reflection questionnaires

We will refer to the "self-reflection questionnaire" and the "other-reflection questionnaire" when referring to the study documents used by participants. We will use the term "self-attribution" and "other-attribution" to refer to the analysis we conducted on participants' self-reflection and other-reflection questionnaires. "Self-attribution" refers to how participants attributed their own graph data. "Other-attribution" refers to how participants attributed other members' graph data. To code the self-reflection and other-reflection questionnaire data, authors of this experiment acted as two independent coders to annotate the data using the annotation scheme described in Table 1 (Cohen's $\varkappa = 0.78$, 84.9%). After annotating the dataset independently, the two coders resolved all disagreements to create the final categorization. 16 out of 576 attributions were annotated by both coders as belonging to two categories (see Table 1), bringing the total number of data points for analysis to 592.

Category	Definition
Dispositional factors	Attribution to communication style, personality, identity, etc.
Situational factors	Attribution to study setting, task, group dynamics, etc.
Language	Attribution to language background, foreign language fluency, etc.
Culture	Attribution to cultural norms and differences, etc.

Table 1. Annotation scheme used for quantitative analysis of the self-reflection and other-reflection questionnaire

4.2 Findings

We first present an overview of graph data in Trial 1 and Trial 2. Next, we present our findings, organized around our four research questions. The findings emerged from an analysis of the qualitative interviews and the self-reflection and other-reflection questionnaires. We interpret these findings within the lens of impression management literature. Participant quotes are referred to by the group number and whether the person is a NS or NNS (e.g. G3-NNS). Finally, we discuss comparisons between Trial 1 and Trial 2 and provide possible explanations for Figure 6.

4.2.1.1. Overview of graph data in Trial 1 and Trial 2

The graph detected verbal and nonverbal behaviors of participants in all groups. The average graph data[15] for Trial 1 and Trial 2 is illustrated in Figure 6. Results from a Chi-square test indicated no significant difference for NS ($\chi^2[3]=0.005$, p=*n.s.*) or NNS ($\chi^2[3]=0.43$, p=*n.s.*) average graph data between Trial 1 and Trial 2.

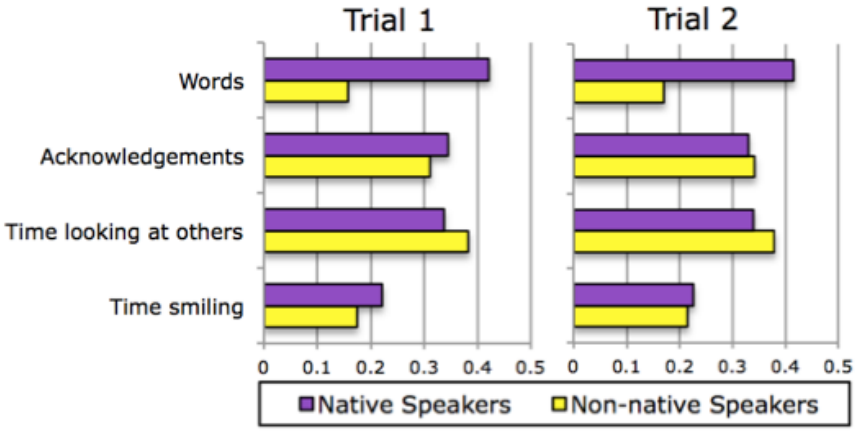


Figure 6. Average graph data for Trial 1 and Trial 2.

[15] Due to a data logging error for three groups, the average graph data in Figure 6 is calculated from 13 out of 16 groups.

4.3 Sub-question #1a: What attributions did NS/NNS make to understand their own graph data?

We first present our quantitative results drawn from the self-reflection questionnaire. Next, we interpret these results from the lens of our qualitative interview data.

NS and NNS differed significantly in how they attributed their own graph data. Our quantitative findings (Figure 7) indicate that NS and NNS differed significantly in how they attributed their own graph data regarding amount of words ($\chi^2[3]=33.0$, $p<.05$), amount of verbal acknowledgements ($\chi^2[3]=12.9$, $p<.05$), time looking at others ($\chi^2[3]=9.61$, $p<.05$) and time smiling ($\chi^2[3]=10.6$, $p<.05$). For all graph measures, NS primarily attributed their own graph data to dispositional factors (e.g. personality, communication style) or situational factors (e.g. task, group dynamics). In comparison, over 85% of NNS attributed "amount of words" to language difficulties and at least 20% of NNS attributed the other graph measures of acknowledgements, time looking at others and time smiling to language challenges as well. Our qualitative findings below reveals that seeing one's own graph data represented different things for NS compared to NNS.

For NS, the graph served as probe to elicit beliefs or perceptions of their concept of self. If NS' graph data matched their self-perceptions or expectations, participants would judge this as an acceptable representation of their concept of self, perceiving that they did "well". Some NS would then attribute their graph data to dispositional factors such as their personality or communication style. For example, *G7-NS2: "[The graph] didn't surprise me. I was happy to know I had the most acknowledgements. Because in group discussions, […] it's important for others to acknowledge that a person is being heard, otherwise that's when the dynamic falls apart. That's important to me."*

G6-NS2: "The graph wasn't surprising. […] I'm an introvert so looking at others and smiling is lower than others [in the graph] because of my personality."

However, sometimes NS' graph data did not match their concept of self. In such cases, participants perceived this discrepancy to be undesirable, where they perceived they did "worse" than they thought. We present the example of G4-NS1, who had the lowest values

on all graph measures, relative to NS2 and NNS. In G4-NS1's interview, he said: "*I felt a bit ashamed [when I saw the graph]. […] It's three equal people in a videoconference, making a decision together. [The measures] should be equal hopefully."* However, in his self-reflection questionnaire, G4-NS1 attributed this discrepancy to situational factors (e.g. the task). For example, for the "smiling" graph measure, he wrote: "*I smiled the least because there were few humorous situations, and I believe there were few suitable situations in the conference to express happiness".* This finding is consistent with attribution theory, which states that actors often use dispositional explanations when the behavior reflects well on them but not when the behavior reflects poorly on them [Jones & Nisbett, 1971].

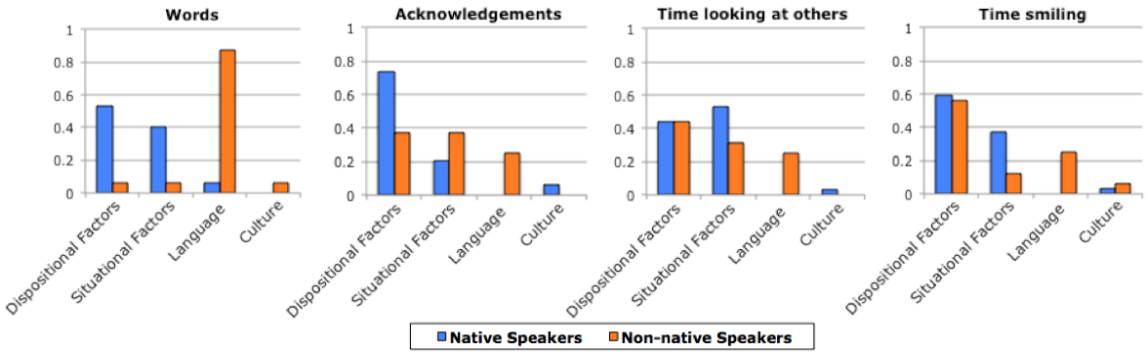


Figure 7. Ratio of self-attributions by NS (N=32) and NNS (N=16) regarding graph data for amount of words, amount of verbal acknowledgements, time looking at others and time smiling.

NNS perceived the graph to be a representation of their behavior when limited by language difficulties, and thus did not discuss the graph in terms of concept of self. Whereas NS participants discussed the graph data in terms of their concept of self, NNS did not. NNS participants interpreted their own graph data merely as a representation of their behavior when constrained by language challenges. This was particularly true for "amount of words", where the NNS in all groups (except three) had the lowest value in Trial 1. (For these three groups, one NNS had the highest words, two NNS had the second highest words). The majority of NNS attributed their "amount of words" graph data to language barriers. For example, *G8-NNS said: "The graph matched my expectations. They're native speakers. There was no chance for me to cut in."*

G9-NNS*: "Words matched my expectations. I was nervous. I wasn't confident in English. I felt it's really different from a discussion with three Japanese people. So I 'shrunk' my body language and that was reflected in the graph."*

For the graph measures of acknowledgements, time looking at others and time smiling, several NNS also attributed this to language challenges. For example, *G13-NNS said: "My acknowledgements is higher because I didn't know how to say it, so I just had more 'uh-huh, ah, mm'."*

G10-NNS: "Because I'm a NNS, it's difficult for me to understand everything by listening. So [looking at] visual cues, facial expressions, gestures helped supplement the things I couldn't understand only from listening."

G9-NNS: "I tried to smile more because I can't speak well in English. So I couldn't do anything else but smile. I didn't want to make the mood bad by making a serious face."

Since NNS felt the graph showed a representation of their behavior when limited by language difficulties, the notion of a discrepancy between the graph data and concept of self was not mentioned by any NNS during the interviews.

4.3.1 Interpretation of Results

While impression management is often understood as peoples' attempts to manage the impressions others form of them [Goffman, 1978; Leary & Kowalski, 1990], it can also refer to peoples' efforts to control their impression of themselves [Greenwald & Breckler, 1985]. People try to maintain certain views of themselves for enhancement or maintenance of self-esteem and development of identity [Greenwald & Breckler, 1985; Leary & Kowalski, 1990]. In our study, the graph acted as a probe that elicited peoples' perceptions about their concept of self. However, this was only true for NS. None of NNS discussed the graph in terms of their self-concept, but rather perceived language limits as an external factor that impacted their behavior during the videoconference.

One interpretation of this result is that unlike NS, NNS are cognitively overloaded with foreign language production, comprehension and thus did not have the usual resources to do impression management as they would in their native language. Since NNS may have felt the graph did not portray an accurate impression of them, the graph did not act as a probe for eliciting their concept of self but rather portrayed a representation of NNS when they are only

able to do "compromised" impression management, particularly on the behaviors they could control (e.g. smiling).

4.4 Sub-question #1b: Did mismatches occur between how NS/NNS attributed their own graph data versus how others attributed their data?

We compared participant responses in their self-reflection questionnaire (how they attributed their own graph data) to their responses in the other-reflection questionnaires (how they attributed other members' graph data). We categorized this using the annotation scheme presented in Table 1.

	Dispositional Factors	Situational Factors	Language	Culture
Words	0.32 (0.53)	0.59 (0.41)	0.09 (0.06)	0.00 (0.00)
Acknowledgements (*)	0.44 (0.74)	0.56 (0.21)	0.00 (0.00)	0.00 (0.06)
Time looking at others	0.27 (0.44)	0.70 (0.53)	0.03 (0.00)	0.00 (0.03)
Time smiling	0.56 (0.59)	0.44 (0.38)	0.00 (0.00)	0.00 (0.03)

** p < .05*

Table 2. Attributions of NS graph data by NNS (NS self-attribution in brackets).

There was no significant difference between how NS attributed their own graph data versus how NNS attributed NS' graph data, except for "acknowledgements". Table 2 presents the ratio of NNS' attributions of NS graph data for the four graph measures: words, acknowledgements, looking at others and smiling. NS self-attributions are in brackets. Results from a Chi-square test showed that the distributions of NNS' attributions of NS graph data compared with NS self-attributions were significantly different for the amount of acknowledgements ($\chi^2[2]=9.89$, $p<.05$). For the other graph measures (words, looking at others, smiling), the distributions of attributions were not significantly different.

There was a significant difference (mismatch) between how NNS attributed their own graph data versus how NS attributed NNS' graph data, except for "acknowledgements". Table 3 presents the ratio of NS attributions of NNS graph data for the four graph measures. Results from a Chi-square test showed that the distributions of NS' attributions of NNS graph data compared with NNS self-attributions were significantly different for amount of words ($\chi^2[3]=7.89$, $p<.05$), and marginally significant for time looking at others ($\chi^2[3]=6.88$, $p=.07$) and time smiling ($\chi^2[3]=7.45$, $p=.06$). The distributions of attributions were not significantly different for acknowledgements. These results indicate that NNS' attributions of NS graph data matched with NS self-attributions, for all measures except "acknowledgements" (Table 2). In contrast, NS' attributions of NNS graph data did not match NNS self-attributions, except for "acknowledgements" (Table 3). Qualitative findings are below.

	Dispositional Factors	Situational Factors	Language	Culture
Words(*)	0.23 (0.06)	0.29 (0.06)	0.43 (0.88)	0.06 (0.06)
Acknowledgements	0.18 (0.38)	0.39 (0.38)	0.18 (0.25)	0.24 (0.00)
Time looking at others (+)	0.16 (0.44)	0.63 (0.31)	0.16 (0.25)	0.06 (0.00)
Time smiling (+)	0.21 (0.56)	0.45 (0.13)	0.27 (0.25)	0.06 (0.06)

** $p < .05$, + $p < .10$*

Table 3. Attributions of NNS graph data by NS (NNS self-attribution in brackets).

Many NS seemed unaware of the magnitude of language challenges experienced by NNS and its impact on "amount of words". In the other-reflection questionnaire, several NS made dispositional attributions of NNS for "amount of words". For example, G10-NS2 wrote: "*[NNS] talked the least because he was polite and let others explain their reasoning first before*

agreeing, disagreeing or elaborating." In contrast, G10-NNS wrote: *"I talked least because my English skill is most least [the worst]."* In a different group, G12-NS1 wrote: *"[NNS] talked the medium amount likely because he was confident about his ideas, but not naturally dominant to take control."* In contrast, G12-NNS wrote: *"I was talking in the medium level because I am not fluent in explaining my opinion in English, so I think it is better if someone else could speak more and initiate the discussion."*

During the qualitative interviews, several NS mentioned their surprise when reading NNS' self-reflection questionnaire with regards to their language difficulties during Trial 1. For example, *G10-NS2 said: "I thought [NNS]'s command of the language seemed rather good […]. He clearly understood the question and had a coherent response. In his self-reflection, he seemed less confident in his speaking abilities than I gave him credit for."* In another group, G2-NS2 said: *"[NNS] said [wrote] she wasn't confident in her English. But I felt, she seemed okay to me. That's the only discrepancy I felt there was."*

Many NS seemed unaware of how language challenges impacted NNS' behavior, with regards to "time looking at others" and "time smiling". We present the example of G1-NS1, who in his other-reflection questionnaire, attributed G1-NNS's "time looking at others" graph data to engagement with the task: *"[NNS] spent the most time looking at others likely because he was intently listening to the conversation".* In contrast, G1-NNS attributed his own graph data for "time looking at others" to language challenges by writing: *"I looked at others the most because I think I cannot understand what other participants say well without looking at them."* For the graph measure of "time smiling", we present the example of G15-NS1, who attributed NNS' behavior to frustration with the task: *"Maybe [NNS] was tied for the least [in smiling] due to frustration and having his list almost completely disagreed with."* In contrast, for "time smiling", G15-NNS wrote, *"I struggle to understand others, so I must focus on listening".*

For many NS, having awareness of how profoundly language challenges impacted NNS behaviors was difficult because group members met for the first time and were unsure what could be attributed to dispositional or situational factors versus language. For example, when asked whether the NNS' graph would change if the conversation had been in his native language, G12-NS2 said: *"Yeah maybe just a bit. Not a massive difference but definitely a discernible difference. […] I'm not sure how much is language and how much is personality. Maybe he's just very introverted."* In contrast, G12-NNS felt his graph data would be significantly different, had it

been in his native language*: "If the task were in Chinese, yeah, I would probably be like [NS1]. But in this situation [because I'm a NNS], I'm definitely not suited for this [leadership] role."*

4.4.1 Interpretations of Results

One interpretation of this result is that NS were able to engage in impression management during the videoconferencing. Thus, the attributions NNS made about NS' graph data matched with self-attributions of NS, for most of the graph measures. In contrast, due to language challenges, NNS may not have been able to engage in impression management during the videoconference. Attribution mismatches may have occurred since NS were not aware of how much language challenges impacted NNS' verbal and nonverbal behaviors. This was reflected in the qualitative interviews, where many NS were surprised to learn about the language struggles mentioned in NNS' self-reflection questionnaires, for "amount of words", "time looking at others" and "time smiling".

4.5 Sub-question #1c: What function (if any) did writing and sharing the self-reflection questionnaire about one's own graph data serve for NS and NNS?

For NS and NNS, writing and being able to share their self-reflection questionnaires with other group members allowed participants to explain or justify their graph data, with the intention to resolve possible mismatches in attributions or impressions. However, the ways NS and NNS used the self-reflection questionnaire to achieve this goal differed.

When NS perceived an undesirable discrepancy between their graph data and their concept of self, NS used the self-reflection questionnaire to write about their ideal self – how they wish they would have behaved. In such cases, NS would mention in their self-reflection questionnaire how they could have communicated or collaborated better in a group. For example, G8-NS1 wrote: *"Apparently I talked the second most. […] Unfortunately, it seems that [NNS] spoke far less than us, so I think we could have done a better job allowing him to speak more."*

G10-NS2 wrote: *"Acknowledgements are useful in letting people know you're listening to them and I should probably use more to make others in the group feel valued."*

NNS used the self-reflection questionnaire to resolve possible attribution mismatches due to language. As identified in sub-question #1a, NNS perceived the graph to be representation of their behavior when constrained by language challenges, where they could only do a compromised form of impression management. Many NNS realized NS might not have this awareness when attributing causality of NNS' graph data. To address this, NNS used the self-reflection questionnaire to explicitly attribute their graph data to language challenges. Some NNS used their self-reflection questionnaire to indirectly ask for help from NS, with the hope that NS would be more understanding to their language difficulties. For example, G1-NNS said, *"My English skill is low, so I can't express myself very well. Sharing the self-reflection gave me another channel to express myself. […] It was really good to share my feelings. But I felt guilty, it was like asking them to pay more attention to me. […] It was good that others got to understand me more. It became easier to collaborate. But I feel like if they *had* to help me, I would feel bad."*

G11-NNS: *"If it's just the graph that's shown, then I feel a bit embarrassed because it's just showing how bad I'm doing. But the self-reflection gave me a chance to explain."*

4.5.1 Interpretations of Results

Impression construction is defined as the process by which people alter their behaviors to affect others' impressions of them [Leary & Kowalski, 1990]. For both NS and NNS, writing and sharing the self-reflection questionnaire allowed participants another channel for impression management and specifically, a tool for impression construction. The self-reflection questionnaire acted as a "meta-channel" to communication, allowing NS and NNS to justify or explain their graph data, with the intention to correct any attribution mismatches. Thus, both NS and NNS used the self-reflection questionnaire for impression construction, in terms of how they wanted others to perceive their graph data and in turn, how they wanted others to perceive them. It is interesting to note that all participants, except one (G12-NS1), believed that what others wrote was indeed an honest reflection of their own graph data. Only G12-NS1 said in his interview that the self-reflection questionnaires of others may not necessarily represent their true character, but rather how they wanted to be perceived by others.

4.6 Sub-question #1d: What influence (if any) did reading others' self-reflection questionnaires have for NS and NNS?

For NS and NNS, reading others' self-reflection questionnaires allowed participants to gain insight and understand the other person better. This often led to intentions to adapt their behavior in Trial 2.

NS became aware of how profoundly language challenges impacted NNS' behaviors, which led to intentions to accommodate NNS more in Trial 2. As identified in sub-question #1b, many NS were surprised at how much language impacted NNS' verbal and nonverbal behaviors. This information usually led NS to having more empathy for NNS, where NS would try to accommodate NNS more in Trial 2. For example, G3-NS1 said: *"[NNS], [he wrote] he felt nervous, he felt pressure, less confidence. […] I wanted him to smile more, speak more. I can't put a finger on how exactly I reacted to that but I wanted to help him make those changes."*

G8-NS2 said: *"In the last task, I tried to give [NNS] more time to talk, because he put me as the 'chairman' [in NNS' self-reflection]. […] I thought maybe I was a bit overpowering, so I tried to mellow out a bit [in Trial 2]."*

Some NS would adapt their communication style to what NNS wrote they needed help on (e.g. speaking slower or looking to give more visual cues). For example, G10-NS2 said*: "It was surprising but definitely explained the graph better. […] I read, […] how a lot of visual information helped him understand the situation more. […] Just how much he picked up visually, made me feel bad for not looking so much at the camera, to give him the information that he was looking for."*

For NNS, reading NS' self-reflection questionnaires sometimes encouraged NNS to participate more in Trial 2. As discussed in sub-question #1c, some NS used the self-reflection questionnaire to write about their ideal self – how they think they should have behaved – when there was a discrepancy between the graph and their self-concept. Such reflections often placed an importance on equal group participation, and sometimes explicitly mentioned the NNS. After reading this, many NNS felt encouraged to participate more in

Trial 2. For example, G8-NNS said: *"They're native speakers. They intentionally gave care to me. It was written there. So I felt happy, I felt like I have to work hard. […] By looking at their self-reflections, I felt encouraged, I felt they gave me more of a chance to talk."*

After reading the self-reflection questionnaire of NS, NNS sometimes adapted to mimic NS' communication style. In the interviews, many NNS talked about learning how to become a "better communicator" through what NS wrote in their self-reflections. For example, G11-NNS said: *"[NS1] wrote she intentionally used fewer acknowledgements since it acts as noise during the discussion. So I also tried to use fewer acknowledgments in the second trial. […] I always thought acknowledgments are polite, to show I'm listening. […] But after I read [NS1]'s self-reflection, oh, I thought that makes sense."*

4.6.1 Interpretation of Results

Reading the self-reflection questionnaire of other members was informative for NS and NNS in different ways. For NS, reading NNS' self-reflection questionnaire allowed NS to gain insight into NNS' language difficulties and its impacts on their verbal and nonverbal behaviors. This often led NS to have more empathy for NNS, which led to intentions to accommodate NNS more in Trial 2. Sometimes, reading NS' self-reflections were also valuable for NNS, in that it motivated NNS to participate more in Trial 2.

4.7 Comparisons between Trial 1 and Trial 2

4.7.1.1. Agreement between individual and group survival item rankings

As a measure of team performance, we calculated a Spearman's correlation coefficient comparing each participant's final item ranking to the group's ranking, for Trial 1 and Trial 2. The correlation coefficient represents participants' agreement with the group ranking after each trial, where agreement reflects participant satisfaction with the group ranking. Correlation values less than one indicate that the participant did not fully agree with the group's decision regarding the importance of one or more of the items. Results from a non-parametric Wilcoxon signed-rank test showed that the difference in NS' agreement score with group ranking between Trial 1 (M=0.87, SD=0.19) and Trial 2 (M=0.84, SD=0.28) was not

statistically significant (Z=0.09, p=*n.s.*). The difference in NSS' agreement score with the group ranking between Trial 1 (M=0.89, SD=0.24) and Trial 2 (M=0.84, SD=0.26) was also not statistically significant (Z=0.17, p=*n.s.*).

4.7.1.2. Average graph data

We now discuss possible reasons why despite intention to adapt behavior, Figure 6 showed no significant change in the average graph data for Trial 1 and Trial 2. We offer several possible explanations.

First, behavior change may have occurred in Trial 2, though the changes in relative position within these groups (i.e. who talked most, who talked second most) were not unidirectional – some participants increased their own graph data, while others decreased their own graph data. Table 4 illustrates that behavioral change in terms of relative position changes did occur within some groups.

Words	2/16
Acknowledgements	6/16
Time looking at others	8/16
Time smiling	4/16

Table 4. Number of groups (N=16) where NNS relative positions changed for amount of words, amount of acknowledgements, time looking at others and time smiling.

Another possible explanation is having an intention to change may not necessarily result in actual behavior change. One reason for this may be group dynamics – it is not enough that one wants to change – others in the group must also allow space for this change. For example, G7-NS1 said: *"In the training and first task, [NS2] was the first one [in amount of words]. […] She reacted to her being the top speaker and tried to slow herself down [in Trial 2]. I had to start the second time. But pretty soon, things went back to the same thing. [NS2] is good at interjecting, in a good way. So we reverted back to our natural personalities."*

Another reason may be that participants felt that they could only change behaviors that were under their conscious control. For some NS, "amount of words" was easier to control,

whereas for some NNS, "time looking" and "time smiling" were easier to control. For example, G3-NS2 said: "*I thought maybe I should change something but I assumed I couldn't change my behavior that much. […] Time looking and smiling is very personality-wise, it's hard to change that automatically. […] But 'words' is easier to control for me."*

In contrast, G6-NNS said: "*In the second trial, […] I tried to look at others more. Within this short time frame, I can't improve my English, so I can't increase number of words. The only thing I could improve is to look at others more."*

This finding may potentially explain why in Table 4, 8/16 NNS changed their relative position for "time looking at others", whereas only 2/16 NNS changed their position for "amount of words".

Finally, although Figure 6 reflected little (actual) behavior change between Trial 1 and Trial 2, several NNS explicitly stated in their interviews that they were happy to be able to share their self-reflection questionnaires with NS members. In many cases, NNS participants said the quality of interaction felt better in Trial 2 and that NS members were more mindful of them. For example, G1-NNS said: *"In the second trial, I felt it was easier to say what I wanted to say. […] Maybe it's because they paid more attention to me. I felt they were more mindful […], I felt they waited more."*

4.8 Opportunities for technology support

We discuss several opportunities for technology support: 1) implications for automatic sensing technologies, 2) provide NNS with alternate channels for impression construction, and 3) highlight the "invisible" language barrier.

4.8.1 Implications for automatic sensing technologies

Peoples' verbal and nonverbal behaviors all contribute to the formation of impressions about them [Ambady & Rosenthal, 1992]. As automatic sensing technologies become increasingly advanced, it becomes easier to non-intrusively detect such behaviors in multiparty meetings. Current approaches often provide quantitative feedback of such detected behaviors, such as a graph showing group participation (e.g. [DiMicco et al., 2004]) or social dynamics (e.g.

[DiMicco et al., 2006, Sarda et al., 2014]). The idea is that such feedback can motivate more balanced group participation and in turn, improve collaboration and productivity [DiMicco et al., 2006].

While such approaches can be beneficial for multiparty groups communicating in the same native language, our findings indicate that providing only quantitative feedback of detected behaviors can be detrimental in teams where members differ in linguistic fluency. As found in our study, NNS felt the graph reflected poorly on them, particularly with regards to detected behaviors they had limited control over (e.g. amount of words). Consequently, we argue that designers supporting NS-NNS interactions should be cognizant of which behavioral cues to detect, how such cues are presented, and most importantly, that the same feedback may elicit different interpretations by NS versus NNS, which in turn, may impact team members' impressions and attributions of one another.

4.8.2 Provide NNS with alternate channels for impression construction

In workplace contexts, the primary dimension in how people evaluate others is impressions of competence (i.e. capability, intelligence, confidence) [Cuddy et al., 2011]. Yet in videoconferencing, impressions of distributed team members are primarily formed based on communication competence cues, rather than on task competence cues [Storck & Sproull, 1995]. This may be because the communication abilities of distributed members are more visible to the camera's eye than behaviors related to task competence [Storck & Sproull, 1995]. This finding may be particularly relevant for NNS, since communication competence is predominately relayed through linguistic fluency – a factor that many NNS in our study felt they had limited control over (in the short-term). One way to address this is to provide NNS with alternate channels to construct or manage impressions of competence, either through explicit self-generated cues (e.g. the self-reflection questionnaire as in our study), explicit other-generated cues (e.g. others' ratings of NNS' task expertise or knowledge), or alternate channels that allow NNS to implicitly convey communication competence and/or task competence (e.g. a collaborative visual workspace).

4.8.3 Highlight the invisible "language barrier"

Our findings revealed that attribution mismatches were frequent in NS attributions of NNS' behavior, compared to NNS' self-attributions. NS participants were often unsure as to whether NNS behavior was due to dispositional factors, situational factors or language barriers. This indicates that the notion of "language barriers" is asymmetric. Although the term suggests the barrier is equally visible to all parties, many NS did not realize how profoundly language barriers impacted NNS' verbal and nonverbal behaviors.

To address this asymmetry, one approach is to highlight the invisible language barrier by 1) supporting NS in gaining awareness of the cognitive load NNS experience, and 2) revealing the potential impacts of this cognitive load on NNS' behavior and self-presentation. To address (1), work such as [Gao et al., 2014, Gao et al., 2015] have explored the use of awareness applications that inform NS of NNS' challenges with comprehension and communication. To address (2), designers might explore how CMC tools can be augmented to support NS in conscious reflection of how they interpret NNS behaviors. Since others' impression-relevant cues are processed at a pre-attentive or nonconscious level [Leary & Kowalski, 1990], creating opportunities for "conscious, intentional inquiry" is an important component of the reflection process [Baumer, 2015] – one that may mitigate inaccurate attributions and cognitive biases. Through conscious reflection, NS may also engage in perspective-taking and develop empathy for NNS, as indicated in our findings. Finally, it is important to note that in our (laboratory) study, NNS were glad to be able to explicitly attribute components of their behavior to language struggles. However, in an ethnographic study of a global tech company that mandated English as lingua franca, NNS employees hesitated to expose their language deficiencies for fear of its impact on the stability of their employment [Neeley, 2013]. This suggests that managing impressions resulting from language barriers is a sensitive and complex issue - perhaps what to reveal and how much to reveal of the "invisible" language barrier in CMC interactions should be managed and controllable by the NNS themselves.

4.9 Future work

We identify several directions for future work. First, our study explored the detection of a small sample of verbal and nonverbal behaviors. Future work should increase this sample to other behaviors that might lead to attribution mismatches between NS and NNS (e.g. speech rate, voice inflections, gestures). Second, our study focused on attribution mismatches stemming from a discrepancy in linguistic fluency. Yet language and culture are intertwined [Yuan et al., 2013], where culture may influence attribution processes [Jones & Nisbett, 1971]. Future research should explore the relationship between culture, language and attributions over CMC. Third, while our study recruited NNS of primarily self- perceived medium fluency, future work should explore the attributions between NS and high fluency NNS. Finally, future work should explore the longitudinal impacts of sharing self-reflections on team members' expectations of one another and its impact on collaboration (e.g. NNS may feel that since NS understand them better, NS should be more considerate of NNS' language difficulties).

4.10 Summary

This chapter presented a mixed-methods experiment to address Research Question #1 and four sub-questions. We conducted an exploratory study to investigate the attributions NS and NNS form about each other in multiparty videoconferencing. Our results show that the graph of detected verbal and nonverbal behaviors, combined with shared self-reflections was an effective probe to elicit impressions and attributions. Our findings revealed significant mismatches in NS attributions of NNS' behavior, but no significant mismatch in NNS attributions of NS' behavior. Due to cognitive overload stemming from language challenges, NNS were only able to engage in a form of "compromised" impression management during the task. Yet, many NS were unaware of how profoundly language difficulties impacted NNS' behaviors. Our findings point to opportunities for NS-NNS technology support, with regards to automatic sensing technologies, alternate channels for impression construction and highlighting the invisible "language barrier".

Chapter 5. Culture and Computer-Mediated Communication: Background and related work[16]

Chapters 3 and 4 addressed the challenge of language diversity in GVTs. In this chapter, we transition to address another challenge GVTs face: the cultural diversity of its team members. We present this research in two parts, which represent two sequential phases of our explorations into this area. In Part 1, we aim to gain a deeper **understanding** of the intercultural communication challenges GVTs face in Computer-Mediated Communication (Chapters 5 and 6) towards Research Objectives III and IV. In Part 2, we discuss the **design and evaluation** of support tools to mitigate intercultural communication challenges in GVTs (Chapters 7 and 8) towards Research Objective V.

In this chapter, we first present the background and related work on culture, intercultural communication and cultural dimensions. Next, we present related work on national culture and its impact on computer-mediated interactions. Following this, we identify gaps in related work and propose Research Questions #2 and #3 to explore this gap.

5.1 Key constructs

We first present foundational constructs which we will refer to throughout this dissertation: culture, intercultural communication and cultural dimensions.

[16] Portions of this chapter are also published in: He, H.A. and Huang, E.M., 2014. A qualitative study of workplace intercultural communication tensions in dyadic face-to-face and computer-mediated interactions. In *Proceedings of the 2014 conference on Designing interactive systems (DIS)* (pp. 415-424). ACM.

5.1.1 Defining "culture"

Culture is a complex and multidimensional construct [Kroeber et al., 1952]. With over 300 definitions and conceptualizations of "culture" [Kroeber et al., 1952], the first challenge is to arrive at an understanding of what "culture" is. In this thesis, I refer to *culture* as "an accumulated pattern of values, beliefs, and behaviors shared by an identifiable group of people with a common history and a verbal and nonverbal symbol system" [Neuliep, 2000]. Thus, culture is not innate, but learned [Hall, 1976], teaching people how to think, feel, behave, and communicate with others [Neuliep, 2000].

Culture can be analyzed on several levels, including continental, national, regional, organizational, and professional [Laroche, 2003]. While the various layers of culture interact and influence each other [Hofstede, 2001], to limit the scope of my research, we focus primarily on *national culture* - defined as the values, beliefs, norms and customs associated with the culture of a nation [Srite et al., 2006]. While no two individuals of the same national culture are identical, members of the same national culture often share similar thinking and behavior patterns [Hofstede, 2001].

National culture is often depicted as an iceberg [Laroche, 2003]. Like an iceberg, a small portion of national culture is above the surface and visible, representing the tangible or external manifestations of a culture, such as dress and appearance, the foods people eat, or the layout of an office building. This part of culture represents surface-level traits, which are visibly apparent and within peoples' awareness and consciousness [Hall, 1976]. Yet, like an iceberg, the largest part of national culture is invisible and submerged beneath the surface, representing deep-level traits that are typically sub-conscious [Hall, 1976]. Deep-level traits refer to peoples' internal values and beliefs, such as concepts of time, the role of people in society, concept of self or the relationship between men and women. Deep-seated values deal with judgements about what is evil versus good, decent versus indecent, moral versus immoral or abnormal versus normal [Hofstede, 2001]. Such values are learned from an early age, they are non-rational and typically remain outside of peoples' conscious awareness – that is, until they become evident through interactions with others from different national cultures, and conflict occurs [Hofstede, 2001]. In other words, values are often invisible, until they become evident

in behavior – one does not notice one's own culture, until interactions with people from other cultures reveal cultural differences and conflict occurs [Hofstede, 2001]. Given the hidden and unconscious nature of deep-level cultural differences, the sources of conflict within culturally diverse teams can be difficult to identify, and even more difficult to resolve [Kirchmeyer & Cohen, 1992]. In this dissertation, we focus on such deep-level cultural differences.

5.1.2 Intercultural communication

Intercultural communication is defined as the "communication between people of different cultures and ethnicities" [Neuliep, 2000]. While miscommunications can occur within the same culture, when messages are transmitted across cultural boundaries, they are encoded in one context and decoded in another, increasing the chance of misunderstanding [Neuliep, 2000]. For example, the encoding of a soft speaking volume is decoded as a sign of shyness or a lack of confidence in the US, while in Japan, the same encoding is decoded as a sign of respect and deference [Laroche, 2003]. As another example, the encoding of smiling is decoded as a sign of friendliness or happiness in the United States, while in the Philippines, smiling can be decoded as a sign of embarrassment [Laroche, 2003]. We refer to the terms "encoding" and "decoding" throughout this dissertation to indicate the construction and interpretation of communication messages.

5.1.3 Cultural dimensions

Culture does not exist in isolation and cannot be observed by itself – one can only define one culture relative to another culture [Hofstede, 2001], where the same culture can be perceived significantly differently by people from different cultural backgrounds [Laroche, 2003]. To compare and describe differences across national cultures, cultural anthropologists have proposed a set of *cultural dimensions,* where a "dimension" is an aspect of a culture that can be measured relative to other cultures [Hall, 1959; Hall, 1976; Trompenaars & Hampden-Turner, 1998; Hofstede et al., 2010; Ting-Toomey, 2012]. Cultural dimensions reflect deep-seated cultural values, which in turn impact a myriad of observable behaviors [Hofstede, 2001]. Communication breakdowns arise when national cultures lie at different points on these cultural dimensions [Hall, 1976; Hofstede, 2001; Ting-Toomey, 2012]. Below, we define a

subset of cultural dimensions that are commonly referenced in organizational literature, and provide examples of how conflicts may arise when individuals interact with others from opposing ends of such cultural dimensions. While the dimensions we present below are not exhaustive of the ones found in organizational literature, we focus on the cultural dimensions we will refer to again in later chapters of this dissertation. All of the dimensions below characterize interactions in face-to-face settings.

5.1.3.1. Power distance

Power distance characterizes how a culture handles inequalities among people and is defined as "the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally" [Hofstede et al., 2010]. High power distance cultures (e.g. Malaysia, Japan, Korea, China) accept a clear hierarchical order in which everybody has a place and which requires no further justification. In contrast, in low power distance cultures (e.g. Sweden, Canada, United States), people strive to equalize the distribution of power and demand justification of inequalities in power. For example, in Japan (a higher power distance culture), placing people in a social system is very important. In fact, it is impossible to interact with someone else if this placing has not occurred. For this reason, it is crucial when meeting someone to state who you are on your calling card – the organization you work for, your position in that organization, your degrees, honors you have received, followed by the family name, the given name, and address, in that specific order [Hall, 1976]. In contrast, in Canada (a lower power distance culture), professional introductions may be made with only the first name, where rank within the organization and honors may be left out, depending on the context of the situation [Laroche, 2007].

5.1.3.2. High-context and low-context

High-context and low-context refers to styles of communication. A *high-context* message is one in which most of the information is in the physical context or the non-verbal code, whereas a *low-context* message is where most of the information is contained in the explicit, verbal code [Hall, 1976]. This dimension is related to the *direct versus indirect styles of communication,* which refers to the extent in which people reveal their intentions using explicit verbal communication or implicit non-verbal communication [Gudykunst & Ting-Toomey, 1988]. High-context

cultures (e.g. Japan, China) tend to use more indirect styles of communication where the non-verbal message is particularly important. In contrast, low-context cultures (e.g. Germany, United States) tend to use more direct communication, where the verbal message contains the primary message. Whereas high-context cultures infer meaning from what is not said, low-context cultures focus on sending and receiving accurate, articulate and explicit verbal messages [Moran et al., 2007]. For example, there is an unspoken belief among the Japanese that putting deep feelings into words somehow spoils their value and that understanding attained without words is more precious than attained through precise articulation [Iwao & Triandis, 1993]. Given this deep-seated cultural belief, when the Japanese say "It is going to be a little difficult", the cultural translation in English for people from Western cultures may be "Forget it, it's not going to happen in a million years" [Laroche, 2007]. Yet, Japanese often assume "their point has been made indirectly and with finesse" [Nisbett, 2010], while the Westerner is "very much left in the dark" [Laroche, 2003].

5.1.3.3. Individualism versus collectivism

Individualism versus collectivism refers to whether people's self-image is defined in terms of "I" or "we". *Individualistic* cultures (e.g. United States, Australia, Great Britain) refer to "societies in which ties between people are loose: everyone is expected to look after him or herself or her immediate family" [Triandis, 1993; Hofstede et al., 2010]. Individualistic cultures possess an independent view of the self, emphasizing uniqueness, stability, self-sufficiency - a self that is distinct from others [Cai et al. 2013]. In contrast, *collectivistic* cultures (e.g. Guatemala, Indonesia, Japan) refer to "societies in which people from birth onward are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty" [Hofstede et al., 2010]. Collectivistic cultures possess an interdependent view of the self, prioritizing harmonious relationships, social duties, and group achievement [Triandis 1995] - a self that is connected with others [Cai et al., 2013]. Individualistic and collectivistic cultures operate according to very different sets of unwritten rules; often such rules are mutually exclusive [Laroche, 2007]. For example, in Japan (a collectivistic culture), one has to "belong" or he has no identity [Hall, 1976]. When a man joins a company, he is hired for life, where the company plays a much more paternalistic role

compared to in the United States (an individualistic culture). There are company songs, and the whole company meets frequently (usually at least once a week) for purposes of maintaining corporate identity and morale [Hall, 1976].

5.1.3.4. Monochronic versus polychronic time

Monochronic versus polychronic time refer to how cultures interpret and handle time [Hall, 1959]. Monochronic cultures (e.g. Switzerland, Germany, United States) tend to emphasize schedules, promptness and segmentation of tasks, where time is "almost tangible"- something to be "saved", "spent", or "wasted", "made up", "crawling", "running out" [Hall, 1959]. In contrast, polychronic cultures (e.g. Mexico, India) tend to emphasize flexibility, spontaneity, fewer adherences to schedules, and are "characterized by several things happening at once". Subsequently, time in polychronic cultures is perceived as less tangible compared to in monochronic cultures. The ways societies handle time is arbitrary and learned, though communicates deep cultural meanings [Hall, 1959]. Yet, because it is so thoroughly integrated into our culture, it is treated as though it were the only natural and "logical" way of organizing life [Hall, 1959]. For example, in Latin America (polychronic cultures), it is not uncommon for one person to be engaged with several different work activities at the same time, where he or she moves between activities, spending a small amount of time spent on each [Hall, 1959]. Being too "obsessed" about achieving a work goal at the expense of being kind and sociable to others is considered aggressive, pushy and disruptive. In contrast, in the United States (a monochronic culture), people typically focus on completing one task at a time, before moving onto the next. Appointments and deadlines are taken very seriously. As cultural anthropologist Hall (1959) states: "monochronic and polychronic systems are like oil and water - they do not mix".

5.1.3.5. Short-term versus long-term orientation

Short-term versus long-term orientation refers to how cultures handle links to its own past, while dealing with the challenges of the present and future [Hofstede et al., 2010] Cultures with short-term orientation (e.g. Pakistan, Nigeria, Canada) are oriented towards the here and now, whereas cultures with long-term orientation (e.g. China, Japan, South Korea) are oriented towards the past and future [Trompenaars & Hampden-Turner, 1998]. When planning for the

future, some cultures tend to plan over a longer time horizon compared to others. For example, during decision-making, Arabs (long-term orientation) tend to look back two to six thousand years for his or her own origins, where history is almost always used as the basis for almost any modern action [Hall, 1959]. Similarly, the Chinese often refer to their 4000 years of continuous history, while Greeks and Italians often refer to history from Ancient Athens and Ancient Rome [Laroche, 2007]. In contrast, the United States (short-term orientation), is oriented towards the immediate future - corporations are typically concerned about their next quarterly results, while employees plan their career over the next two to three years [Laroche, 2007].

5.2 Related work: Culture and CMC

In face-to-face settings, national culture contributes to significant differences in communication, teamwork and collaboration styles [Adler, 1983; Hall, 1976; Laroche, 2003]. Given the prevalence of distributed work patterns in recent years, researchers have also investigated the influence of national culture on computer-mediated interactions. Below, we present related work in CSCW and categorize it into three themes: 1) the impact of national culture on how people use CMC, 2) the impact of national culture on media preferences, and 3) intercultural communication challenges in CMC.

5.2.1 The impact of national culture on how people use CMC

One area of research has explored the impact of national culture on how culturally diverse team members use CMC. This theme of research explores whether CMC media is used in the same way across cultures, or whether cultural differences exist in how people use CMC media to accomplish certain tasks. For example, in a study of Doodle[17] – an online event scheduling tool, Reinecke et al. (2013) found cultural differences in how people coordinate and schedule events online, with regards to response time and consensus seeking. The authors attributed such differences to national culture differences such as individualism-collectivism and

[17] Doodle is an online event scheduling tool, based in Switzerland. www.doodle.com

monochronic versus polychronic time. Setlock et al. (2004) investigated the impact of national culture on how dyads approached a decision-making task in Instant Messaging and in face-to-face. Differences were found with regards to how culturally diverse participants used media - Chinese dyads talked more in face-to-face, compared to Instant Messaging to complete the decision-making task, whereas American dyads talked equally in both media. The authors attributed this difference to an emphasis in Chinese society on relationship building, which is related to the high-context versus low-context cultural dimension. Wang et al. (2009) explored the impact of national culture on how groups brainstorm, in text-only chat compared with video-enabled chat. Cultural differences were found with regards to how talkative and responsive participants were, where behaviors differed across media. Nguyen and Fussell (2014) explored how same-culture and cross-culture pairs express involvement in text-based Instant Messaging. Results found cultural differences in how American and Chinese participants used verbal involvement cues in Instant Messaging. Bi et al. (2014) investigated the impact of national culture on how team members used an Instant Messaging chat system with an awareness display. Cultural differences were found with regards to how Americans versus Chinese used this system to gather awareness information about their partner. Overall, studies like these demonstrate that contrary to popular opinion, "Internet users have not converged into a homogeneous subcultural group with the same behavioral norms across the world, but that their use of technology considerably differs between countries" [Reinecke et al., 2013]. In other words, cultural differences do exist with regards to how people use CMC to accomplish tasks.

5.2.2 The impact of national culture on media preferences

Another thread of research has explored the impact of national culture on what media culturally diverse people prefer. This area of research investigates whether the same media are preferred or valued across all cultures, or whether people from different cultures prefer different media. For example, Kayan et al. (2006) found that multiparty chat, audio-video chat and emoticons were much more popular in Asia than in North America. The authors attributed such differences to individualism-collectivism and high-context versus low-context styles of communication. Lee (2002) investigated the use of email and fax in Korean virtual

teams. Korean team members preferred fax over email when interacting with superiors, feeling that email (due to its efficiency and convenience) did not convey the appropriate amount of formality and respect (i.e. power distance) they felt was required in interactions with senior members. Massey et al. (2001) found lower satisfaction among Asians participants when using asynchronous CMC media, compared to Americans and Europeans. The authors attributed this to the importance of continuous feedback and social cues in high-context (Asian) cultures compared to low-context (American) cultures. Choi et al. (2005) found that Asian participants relied on visual elements in a mobile text service interface, whereas Finnish participants only relied on textual elements. The authors attributed this to visual perceptive differences in high-context versus low-context cultures. Zakaria & Talib (2011) interviewed Chinese, Indian, and Malaysian GVT managers and found cultural differences in media preferences relating to relationship versus task-focus during workplace interactions. Setlock & Fussell (2010) interviewed participants from America, Korea, India, and China about their perceptions of various media and their motivations for choosing certain media in different hypothetical settings. Results found that "richer" media was not always perceived as better by Asian participants. In contrast to Americans, Asian users made deliberate choices about which media to use, depending on whether they wished to convey or mitigate emotional information, depending on the situation and the relationships in question. Overall, the above studies provide evidence that media do not offer the same perceived value across cultures; rather, different cultures have different media preferences.

5.2.3 Intercultural communication challenges in CMC

A third thread of research is the impact of national culture on CMC interactions in distributed work teams. This area of research investigates what intercultural communication challenges occur when remote members interact over CMC media, and how the various characteristics of media help or hinder intercultural communication. For example, Shachaf (2008) investigated the impact of cultural diversity on GVT team effectiveness in CMC interactions. Shachaf identified several intercultural communication challenges, arising from direct versus indirect styles of communication, succinct versus elaborate communication styles, contextual versus personal styles, instrumental versus affective styles, and polychronic versus

monochronic time. Results found that CMC media was able to mitigate intercultural communication challenges within GVTs. Min et al. (2010) explored communication effectiveness in GVTs with members based in various Asian countries. Results found communication challenges arising from task-focused versus relationship-focused working styles, which the authors attributed to high-context and low-context cultural dimensions. Huang et al. (2007) identified communication challenges between US and Chinese GVT members, with regards to direct versus indirect communication styles and relationship versus task-focused work behaviors. In a study by Nguyen & Fussell (2010), retrospective analysis was used to identify how Chinese-Chinese, American-American, or American-Chinese dyads felt at different points in a previously recorded audio-video conversation. The goal was for participants to retrospectively identify points of perceived conflict during the conversation. In follow-up studies, Nguyen & Fussell (2012, 2013) conducted retrospective analysis of dyads' Instant Messaging conversations. Cultural differences were found with regards to participant perceptions of their partner's involvement as well as emotional reactions to their partner's messages. Overall, the above studies demonstrate that communication challenges do arise from differences in national culture when distributed team members use CMC.

5.3 Gaps in the literature

Current research exploring the relationship between national culture and CMC has primarily focused on three areas: 1) the impact of national culture on CMC usage, 2) the impact of national culture on media preferences, and 3) intercultural communication challenges in distributed work teams using CMC. It is this third area of research which we contribute to in this dissertation.

In the research about intercultural communication challenges in CMC, some gaps in the literature remain. First, research exploring the impact of national culture in face-to-face settings is largely separate from the literature exploring the impact of national culture in CMC. Current studies focus either on face-to-face or on CMC, with only a handful of studies comparing face-to-face with a single type of CMC (e.g. Instant Messaging) (e.g. Setlock et al., 2004). However, face-to-face and various types of CMC (e.g. email, Instant Messaging, videoconference) differ significantly in their "richness" and capacity to convey information

cues [Daft, 1987]. For example, in culturally diverse teams, email – a "lean" asynchronous text-based medium - might afford different communication challenges compared to face-to-face – a "rich" medium that conveys contextual information and verbal and non-verbal cues. Lean media such as email can result in misinterpretations of messages, due to an absence of instantaneous feedback and non-verbal cues such as body language and tone of voice [Andres, 2002]. Face-to-face on the other hand, can allow interlocutors to retrieve immediate visual feedback and make rapid adjustments if necessary [Storper & Venables, 2004]. Face-to-face interactions also convey the transfer of tacit knowledge [Bower et al., 2001], and knowledge that is not written or definable, but gained through experience [Griffith et al., 2003]. Yet, some theories propose that rich media is not always superior to lean media in an intercultural context. According to Carte & Chidambaram (2004), rich media (e.g. videoconference) can emphasize surface-level diversity cues (e.g. ethnic background), which can lead to stereotyping and social categorization. Lean media, on the other hand, reduces access to surface-level diversity cues, in turn downplaying cultural and linguistic differences within a distributed team.

Since current intercultural studies typically focus either on face-to-face or on CMC, the literature lacks a broad understanding of how national culture influences communication across a wide spectrum of media. Such an understanding is important in order to design effective support tools to mitigate intercultural communication challenges. From this perspective, I identify my next research question:

Research question #2:	What kinds of communication challenges do culturally diverse professionals experience in face-to-face and CMC? Specifically: What challenges (if any) are unique to face-to-face? What challenges (if any) are unique to specific types of CMC? What challenges (if any) are common across face-to-face and CMC media?

Another gap remains largely unexplored in related work. While earlier media theories argued that CMC limits peoples' natural communication patterns due to reduced social presence and exchange of cues, more recent theories argue that "media are malleable", where given enough time and experience, CMC features can "enhance aspects of communication,

instead of just restricting them" [Carte & Chidambaram, 2004]. Yet, the literature is sparse with regards to how (or if) professionals adapt when communicating with culturally diverse people over face-to-face and CMC media (for exceptions, see [Anawati & Craig, 2006; Cramton & Hinds, 2014; Wang et al., 2009; Zakaria & Talib, 2011]). However, since some level of adaptation is required for successful intercultural interactions [Laroche, 2003], understanding how, if or when professionals adapt in different media is crucial to designing effective solutions to facilitate intercultural communication. From this perspective, I identify Research Question #3:

Research question #3:	Assuming intercultural communication challenges exist, what adaptations (if any) do professionals make to mitigate such challenges in face-to-face and CMC media?

The next chapter addresses these research questions.

5.4 Summary

This chapter provided background and related work regarding the challenge of cultural diversity in global virtual teams. We first presented foundational constructs about culture, intercultural communication and cultural dimensions. Next, we presented related work in CSCW that investigated the relationship between national culture and CMC. We categorized this related work into three sections: the impact of national culture on CMC usage, the impact of national culture on media preferences, and intercultural communication challenges in CMC. In this dissertation, we contribute to this third thread of related work by identifying a gap in current literature and proposing Research Questions #2 and #3, towards Research Objectives III and IV. The next chapter addresses these research questions by presenting an exploratory qualitative study of intercultural communication challenges in face-to-face and a broad range of CMC media.

Chapter 6. Understanding intercultural communication challenges in face-to-face and computer-mediated communication[18]

This chapter addresses Research Questions #2 and #3. ***Research Question #2 asked: What kinds of communication challenges do culturally diverse professionals experience in face-to-face and CMC?*** Specifically, we explore:

- ***What challenges (if any) are unique to face-to-face?***
- ***What challenges (if any) are unique to specific types of CMC?***
- ***What challenges (if any) are common across face-to-face and CMC media?***

Research Question #3 asked: Assuming intercultural communication challenges exist, what adaptations (if any) do professionals make to mitigate such challenges in face-to-face and CMC media?

To address the above research questions, we conducted a formative qualitative study with 28 participants regarding the intercultural communication challenges they experienced in face-to-face and CMC workplace interactions. Before conducting this study, we anticipated that there would be a set of intercultural communication challenges that were unique to face-to-face, a set that was unique to CMC, and a set that was common to both. However, what emerged was that the most frequently occurring intercultural communication challenges in our dataset were common to both face-to-face and CMC, regardless of the medium used. These include: accepted range of emotional expression, level of formality, "fixed" versus flexible appointments and task versus social-orientation. While intercultural communication challenges unique to face-to-face and unique to various types of CMC did exist, such challenges were not strongly represented in the dataset and therefore inconclusive. Contrary

[18] Portions of this chapter are also published in: He, H.A. and Huang, E.M., 2014. A qualitative study of workplace intercultural communication tensions in dyadic face-to-face and computer-mediated interactions. In *Proceedings of the 2014 conference on Designing interactive systems (DIS)* (pp. 415-424). ACM.

to previous research by Shachaf (2008), our findings did not find that CMC tools dissolved or mitigated intercultural communication challenges, compared to face-to-face. These findings address Research Question #2. To address Research Question #3, we present examples of mimicry adaptation – when participants successfully mimicked or copied the behaviors of culturally diverse coworkers to mitigate intercultural communication challenges. We draw upon these mimicry adaptations as inspiration for design. We also present the barriers other participants encountered when adapting behavior, including barriers to interpreting (decoding) interpersonal feedback and barriers to adapting (encoding) behavior. Overall, our findings indicate that culture will be a persistent variable influencing workplace intercultural communication regardless of the medium, highlighting the opportunity for better technological support. In the following, we present the methodology and findings from this study. Based on these findings, we discuss opportunities for technology support. We conclude with limitations and future work, and a summary of this chapter.

6.1 Methodology

We conducted an exploratory, qualitative study with 28 participants (30 interviews, with two return participants) to explore the intercultural communication challenges professionals experience in face-to-face and a broad range of CMC interactions. All interviews (15 female, 15 male) were conducted in English and in person, in Zurich, Switzerland. Participants were compensated a monetary amount equivalent to ~$40USD, a typical amount for study participation in Zurich. Interviews took place at the university, with the exception of four, which were conducted at a coffee shop, at the participants' home and two at the participants' workplace. Interviews lasted between one and three hours, with an average interview duration of approximately two hours. All interviews were audio-recorded and with the permission of participants video-recorded and then fully (27/30) or partially (3/30) transcribed. A total of 338074 words were transcribed. Supplementary materials regarding Methodology are presented in Appendix B of this dissertation.

Our first 15 interviews were conducted in 2012 and concerned workplace intercultural communication challenges in face-to-face media. Participants were recruited from online expatriate forums, a University marketplace, and a government integration office. Participants

were selected based on two criteria: 1) they emigrated from their birth country after the age of 18, and 2) they work (or previously worked) in a traditional office environment. Criteria 1 was used since cultural values are programmed early in our lives, where it is typically adults (not children) who find it hardest to adapt to a new culture [Hofstede, 2001]. Criteria 2 was imposed to explore challenges that arise in "conventional" indoor, office settings with 9-to-5pm work schedules (as opposed to construction sites, hospitals, fire rescue, etc.). Our next 15 interviews were conducted in 2013 and concerned workplace intercultural communication challenges in CMC media. Email, telephone or audioconference, Instant Messaging and videoconferencing were targeted explicitly in our questions. Participants were recruited from online expatriate forums and snowball sampling and selected based on their birth country, gender, age and experience using one or more CMC tools with culturally diverse professionals. Two people were return participants from our first 15 interviews.

Interviews were semi-structured. Questions began with the participant's migration story (when, why, where, who), countries lived and worked in, and current and previous professional roles. Following this, inquiries were open-ended, such that the most pressing issues for participants guided the conversation. Our first 15 interviews regarding face-to-face interactions explored workplace communication challenges, comparisons between home and host culture(s), unspoken workplace rules, integration challenges and perceptions of own cultural identity. Our next 15 interviews regarding CMC interactions explored CMC communication partners (e.g. distributed/collocated, national culture, frequency of communication), comparisons of CMC interactions with same-culture versus different-culture professionals, benefits and drawbacks of different media, unspoken rules of CMC usage, impression formation over various media and media usage on different devices.

Birth countries included England (4), China (3), Germany (3), India (3), Canada (2), Romania (2), Switzerland (2), USA (2), and one participant each from Croatia, France, Jordan, Latvia, Malaysia, Mexico, Philippines, Poland and Tunisia. Occupational sectors included academic research (7), finance (5), Information Technology (4), marketing (3), banking (2), government (2), transportation (2) and one participant each from aviation, education, food

service, law, and translation. Age brackets included 26-35 years (19), 36-45 years (5), 46-55 years (4), and 18-25 years (2).

6.1.1 Data coding and analysis

We used inductive open coding to analyze the interviews for instances of workplace communication challenges that we believed might have implications for the design of communication technologies. We coded for communication challenges for which the participant mentioned or attributed culture as a potential reason as well as general communication challenges unrelated to culture (e.g. bandwidth problems over videoconferencing). Throughout our analysis, we drew upon media dimensions (Table 5) as defined in Media Richness Theory [Dennis & Valacich, 1999] as a lens to explore how different capabilities of media support or hinder workplace intercultural communication. We refer to these dimensions throughout this chapter. Due to scope, we do not present communication challenges that participants attributed to language barriers, though we discuss the importance of language in the "Limitations and Future Work" section.

Immediacy of feedback	The extent to which a medium enables rapid bidirectional communication (feedback) between sender and receiver.
Symbol variety	The capacity of a channel to transmit information. Within the Human-Computer Interaction community, "symbol variety" is typically understood as the "richness" of a medium.
Rehearsability	The extent to which a medium enables the sender to rehearse or fine-tune the message for sending.
Reprocessability	The extent to which a message can be re-examined within the context of the communication event.

Table 5. Media dimensions from Media Richness Theory [Dennis & Valacich, 1999].

6.2 Findings: Intercultural communication tensions

The most frequently occurring intercultural communication challenges were common to both face-to-face and CMC, regardless of the medium used. These include: accepted range of

emotional expression (22/30 interviews), level of formality (22/30 interviews), "fixed" versus flexible appointments (20/30 interviews) and task versus social-orientation (15/30 interviews). While these challenges are not exhaustive of the intercultural communication challenges in our transcripts, they represent the most frequently occurring challenges across face-to-face and CMC interactions based on our participant sample. While our analysis suggested that intercultural communication challenges unique to face-to-face interactions and unique to specific types of CMC do exist, such challenges were not strongly represented in the data and therefore inconclusive.

Throughout this chapter, we refer to these intercultural communication challenges as "tensions" – tensions reflect a specific type of challenge in that it indicates two forces pulling in opposite directions. We use this term to represent the opposing intercultural perspectives participants encountered. This section is structured as follows. For each tension, we highlight two opposing perspectives and unravel the ways the tension manifested in face-to-face and CMC media. We offer interpretations for these tensions by drawing upon theories of cultural dimensions as defined in cultural anthropology literature. Next, we present the successful adaptations some participants made to mitigate such tensions, later drawing upon these adaptations as inspiration for design. Following this, we present the barriers other participants encountered when adapting behavior. Throughout this section, we refer to media dimensions (Table 5) using square brackets (e.g. [rehearsability]) and participant quotes using "PX (Y)" where X represents the participant number and Y their birth country (e.g. P6 (China)). When relevant, we include the prefix [FTF] to indicate face-to-face interactions, or [CMC] to indicate the type of interaction.

Note: Comparisons of national cultures always run the risk of stereotyping people within one country [Laroche, 2007]. Our intent is not to make claims regarding behaviors of one cultural group or another, but rather to argue that cultural differences do contribute to workplace communications tensions when people interact over face-to-face and CMC media. Additionally, since one culture can only be defined relative to another culture [Hall, 1976], in our presentation of participant quotes, we interpret relative participant cultural traits from the perspective of the cultural background of the person they communicated with. The tensions

we discuss therefore represent leanings towards one side or another of the cultural continua, though in reality, participants fall somewhere along the cultural spectrum, rather having purely one orientation or the other.

6.2.1 Tension: Range of emotional expression

Differences in the accepted range of emotional expression emerged as an intercultural communication tension in 22 out of 30 interviews. On one side of the scale are participants who do not express significant positive or negative emotions in the workplace, where being able to control the display of one's emotions (particularly negative emotions) is valued. On the other side of the scale are participants who freely express both positive and negative emotions, where consistency between what one feels and what one displays is valued. While our data indicated tensions in the expression of both positive and negative emotions, we focus on negative emotions since this was the primary source of intercultural conflict in our interviews.

Differences in the accepted range of emotional expression led to tensions in both face-to-face and CMC interactions. On one hand, participants who were more emotionally expressive interpreted people who were less emotionally expressive as "cold" and "distant". In face-to-face and video interactions, such interpretations were often based on non-verbal cues, such as tone of voice, eye contact, gestures or facial expressions. In face-to-face interactions, lack of touch and greater conversational distance also contributed to interpretations. For example: *[FTF] P11 (Romania): I found them [Swiss] extremely cold for me and very distant. I guess it has to do a lot of with the non-verbal communication. […] The tone of their voice, it seemed for me very strict and created a kind of distance. And the fact that they are not emotional. It's just like they are cut of the emotion.*

In text-based CMC interactions, "coldness" was often interpreted through a lack of explicit emotional or "feeling" words. For example: *[CMC] P25 (Mexico): In the case of the Germans. I was emotional, I was stressed, I was shouting [over the phone]. And they were just focused and cold, just saying [over email], "We are working on it."*

On the other hand, less expressive participants felt overwhelmed when strong negative emotions were exhibited by more emotionally expressive people, interpreting such expressions

of negative emotion as "unprofessional" and "inappropriate" for the workplace. In face-to-face, negative emotions manifested in non-verbal cues (e.g. voice loudness) and explicit negative words. For example: *[FTF] P10 (Canada): They were a group of Russians who had done all the technical part and they were very emotional. […] You'd ask them a question and they'd yell and scream at you. […] She'd say, "Boy, are you stupid? Where did you dream up such crazy things?"*

In text-based email interactions, emotions manifested in the use of negative emotional words as well as the general "tone" of the message (e.g. conveyed through exclamation marks, capital letters, highlighted text). For example: *[CMC] P29 (Germany): French people, […] they easily write very emotional words. […] Like my boss always likes to say, "If we don't do this today, then we will all die!" […] I never heard something like this from a German or Swiss person. […] They [Germans or Swiss] would think "What's wrong with you? Why you be that difficult?" […] I also find it stressful sometimes when people need to be so emotional in their conversations and in their emails.*

Some less emotionally expressive participants also perceived the use of positive and negative "emoticons" in work-related emails and Instant Messaging messages as "unprofessional" and "inappropriate". Some felt the use of emoticons to express genuine negative emotions as contradictory due to their "amusing" or "entertaining" nature. Our data did not include explicit mention of positive or negative emoticon usage by more emotionally expressive participants.

6.2.1.1. Interpretation of Cultural Dimension

Emotional expression varies greatly between cultures and can wreak significant havoc in multicultural teams [Laroche, 2003]. One interpretation for this tension is the different cultural ranges of acceptable displayable emotions in a professional setting [Laroche, 2003]. For example, Latin Americans, Latin Europeans and Arabs display significantly more emotion in the workplace than in North America and may be perceived by less emotionally expressive cultures as being out of control or aggressive [Laroche, 2003]. On the other hand, East Asians typically display significantly less emotion in the workplace than in North America and may be perceived by more emotionally expressive cultures as being disinterested [Laroche, 2003].

6.2.1.2. Adaptations

To mitigate tensions between different ranges of emotional expression, more expressive participants adapted in face-to-face and audio interactions to use "milder" non-verbal expressions of both positive and negative emotion, such as reducing loudness of voice, laughing less, or in general, appearing less "extroverted". For example: *[FTF] P10 (Canada): I'm trying new techniques to adapt my outside appearance and demeanor to different [Swiss] companies. Usually I'm much more vivacious, […] more chatty and joking around. […] But in the last few months, I've noticed I've become…I sound more serious, I look more serious. I think that's going to make a difference as well.*

In email interactions, some emotionally expressive participants felt regret after sending negatively emotional emails and developed a goal to "calm down" before sending such emails in the future. For example: *[CMC] P25 (Mexico): In my personal view, it was a normal email. I was just expressing, "I need you to do this, why you didn't do that?" […] Then a friend [from the German team] told me, "You know, it seems like your [e]mail was a love letter, reclaiming [complaining about] something to your boyfriend like "Why you did this to me?!" […] And even using these exclamation signs […] which for us, it's common. […] For them, it's kind of insulting. […]For them, it's like I'm shouting and I didn't know it. […] He was like, "You even wrote something in red color! That was like you slapped me on the face." […] Now I know that was not very well-educated from my side, not very respectful. […] But for me, in that moment, I feel like I needed to do it. […] Now, I learned that maybe I need to not do it like that.*

On the other hand, some less emotionally expressive participants adapted in text-based CMC interactions to provide non-verbal cues of their current emotional state, particularly if it was negative. For example: *[CMC] P28 (Switzerland): People never see me angry. He [Indian colleague] once said, "See? I find this very disturbing. If I really behave like an idiot towards you, why are you not getting disturbed? I think I don't mean anything to you!" […] He started it and then I adapted rather. […] I would tell him [over email], "I'm very angry right now, I really thought you would send it to me, and you never again wrote to me."*

[CMC] P30 (Switzerland): [In email], I try writing how I feel, […] in what kind of mood I am. […] To give that information even though it cannot be seen or heard. […] If it's a difficult situation, it's better to fill that in firsthand if you can't talk or speak FTF, so not to leave much room for interpretation.

Our data did not contain explicit mention of adaptations by less expressive participants to increase their emotional expression over face-to-face, audio or video-based communication. Our finding of consistent expressions of emotion in face-to-face and CMC media support Derks et al. (2008)'s conclusion that "emotional communication online and offline is surprisingly similar", where the only difference is people use "more frequent and explicit emotion communication in CMC than in face-to-face". Our findings also support arguments that people can adapt and overcome cue limitations of CMC media [Walther, 1992]. In this case, our data did not support Shachaf (2008)'s finding that CMC "eliminated differences in non-verbal styles" and "mitigated differences in verbal styles".

6.2.1.3. Opportunities for technology support

We propose several opportunities for technology support for cultural differences in emotional expressiveness. First, technologies could support users in the accurate decoding of culturally diverse emotional displays. For example, in high [symbol variety] media (e.g. video, Google Glass), facial recognition capabilities can be used to "translate" culturally different expressions of emotion by "toning up" or "toning down" to the appropriate cultural reference frame. Since emotions can be expressed and sensed through text among same-culture individuals [Hancock et al., 2008], text-based CMC might explore use the use of linguistic analysis to detect both "explicit" (i.e. reference to emotional labels) and "implicit" (i.e. emotional style of the message) expressions of cultural emotion [Derks et al., 2008].

Second, technologies could support users in the encoding of culturally appropriate emotional expression. In face-to-face interactions, technologies might help users encode "culturally appropriate" non-verbal expressions (e.g. conversation distance, touch, eye contact), while in high [symbol variety] media (e.g. video), features such as facial morphing might provide cues as to whether one should increase or decrease emotional expressiveness based on their communication partner. Since emotional contagion occurs in both face-to-face and text-based media [Hancock et al., 2008], fields such as affective computing [Picard, 2000] or personal informatics [Li et al., 2011] might support emotionally expressive people in gaining awareness of their emotional state before sending (or not sending) emotionally charged messages.

6.2.2 Tension: Level of formality

Differences in the preferred level of formality emerged as an intercultural communication tension in 22 out of 30 interviews. On one side of the scale are participants who prefer to communicate on an informal basis, (generally) regardless of the relationship between sender and receiver. On the other side are participants who convey varying levels of formality, depending on the relationship between sender and receiver.

Cultural differences in the preferred level of formality led to tensions. In face-to-face, participants with high formality used actions (e.g. greetings, farewells, gift-giving) as well as non-verbal cues (e.g. reduced eye contact, greater conversational distance) to express formality. Such actions were sometimes interpreted as uncommon or strange by people with lower levels of formality. For example: *[FTF] P13 (India): If I try to give respect to our teachers [professors] [in Switzerland], they don't want it. […] In the beginning, I used to leave some fruit on the table and he don't like to accept this. […] [In India], it's common, to give some fruit or some gifts to your professors.*

In email, formality manifested in written conventions such as subject lines, greetings, farewells, punctuation and grammar, where higher formality participants struggled with knowledge of shared conventions. For example: *[CMC] P16 (Germany): It's difficult to phrase these emails. […] Like do I say "hi", "hello", "dear whatever"? Do I say first name or last name or both? Title, yes, no? Abbreviation? Like Mister, Missus, Miss? […] There are so many small things and yeah, I still can't figure this out. Like what should I close my email with? Like "Regards", "Sincerely", "Best wishes", "Greetings", "Ciao", "Thanks", nothing? […] It takes such a long time, I don't know.*

On the other hand, participants who preferred to communicate on an informal basis felt uncomfortable or awkward when others were overly formal. For example: *[FTF] P26 (England): Speaking face to face, […] you would find that people would keep slightly greater distance from you, wouldn't make eye contact with you, would call you "Sir" a lot, things like that.*

[CMC] P26 (England): The emails I would get from students of all different ethnicities and backgrounds would be overly formal in their language. […] It was highlighted more with people from an Indian background. […] Like "Exalted Sir, I am honored to be talking to you today." […] I hate it. I really hate it. Because I think I'm not a "Sir", I haven't been knighted. I don't have an award. I'm just a Mister. You can call me "[first name]" if you want.

Tensions in formality also manifested in the dimension of *time* – how soon one can become less formal during workplace interactions. This finding was most pronounced in CMC, such as email and phone. For example: *[CMC] P25 (Mexico): I've been working with a Japanese guy for six years. I always try to call him by his first name, like friends. Because when you work so much, even through email, you kind of get to know the person. […] Even six years, […] we've never come close to call each other by [first] name. It's always in a very respectful way.*

[CMC] P18 (England): In other countries, it can be more relaxed. Once you have met the person and built a working relationship with them, the formality of the email often goes down. […] In Switzerland, I've noticed, even though […] you've met and you're working on something together, they still prefer everything to be very formalized […]- to have "Mr" or "Mrs" "or Miss", and the full name. And you would be expected to have the official endings to the emails.

Finally, for all participants, the choice of media also communicated a level of formality. However, our data was inconclusive as to whether participants' perceptions of media "formality" arose from cultural preferences, characteristics of the medium or other factors.

6.2.2.1. Interpretation of Cultural Dimension

One interpretation for this tension is the concept of *power distance* - "the extent to which an unequal distribution of power is accepted by members of a society" [Hofstede, 2001]. People from high power distance, hierarchical cultures may use more formality, depending on the relationship between sender and receiver. People from low power distance, egalitarian cultures may use lower formality regardless of the relationship between sender and receiver. Another interpretation is *high-context* and *low-context* relationships [Hall, 1976]. High-context relationships take longer to form, though once formed, loyalty is never questioned [Hall, 1976]. In contrast, low-context relationships are easy to form, but the bonds that tie people together are "somewhat fragile" where people "withdraw if things are not going well." [Hall, 1976]. As such, high-context relationships begin more formally for a longer period of time, whereas low-context relationships may begin more informally with a lower level of relationship commitment.

6.2.2.2. Adaptations

In text-based interactions (e.g. email and Instant Messaging), higher formality participants mitigated tensions by making use of the media dimensions of [reprocessability] and [rehearsability], to review the writing style of their communication partner and mimic it. For example: *[CMC] P16 (Germany): Something I usually do is, if someone is higher up in the food chain than I am, I adapt to their style [in email], like their opening and finishing.*

Lower formality participants adapted in face-to-face interactions by explicitly encouraging less "formal" non-verbal behaviors (e.g. keeping rather than avoiding eye contact). In CMC interactions, some lower formality participants also consciously selected media with medium to high [immediacy of feedback] and low [symbol variety] (e.g. IM) to initiate "informal" conversations. For example: *[CMC] P26 (England): Through Facebook, it was much more informal, so people relaxed and would let their guard down. So that changed the communication as well. […] The chat system within there is much more informal. And once you send somebody a message in that form of style, somebody emails you back as a response to that message, will copy that register, in the same kind of language.*

This tension echoes Lee (2002)'s qualitative study where South Korean employees choose face-to-face or telephone instead of email for communicating with superiors, for fear that it did not convey the appropriate level of respect.

6.2.2.3. Opportunities for technology support

While tensions arose due to decoding different formality behaviors, we argue that formality encoding was the greatest challenge for most participants. As such, we believe an interesting direction for exploration is the design of technologies to support encoding of culturally different formality behaviors. In face-to-face interactions, technology might offer real-time, contextual training of non-verbal cultural conventions, such as greetings and farewells. For example, wearable computing [Abowd et al., 1998] can support users in practicing bowing behaviors in Japan, or proxemics sensing [Ballendat et al., 2010] could inform users of culturally appropriate conversation distances. In text-based CMC, status-aware applications [Gilbert, 2012] can augment media offering [reprocessability] and [rehearsability] to infer the recipient's preferred level of formality and provide suggestions of how to mimic it. Finally,

since media choice can signify levels of formality, respect, and intimacy [Richardson & Smith, 2007], technologies might also support users in "culturally appropriate" decisions of media choice.

6.2.3 Tension: "Fixed" versus flexible appointments

Different perceptions in the "fixedness" of appointments emerged as an intercultural communication tension in 20 out of 30 interviews. On one side of the scale are participants who view appointments as relatively "fixed", where being late or frequently changing the appointment time is interpreted as rudeness or lack of competency. On the other side of the scale are participants who view appointments as "flexible", where being late is common and even expected. For such participants, appointments are "negotiated" along the way, where it is common to change scheduled plans if other spontaneous opportunities emerge.

Different perceptions in the "fixedness" of appointments led to tensions. Participants who viewed appointments as "fixed" felt frustrated when meetings began or ran late, or when the other person did not show up. For example: *[FTF] P28 (Switzerland): He'll [Professor in India] say, "Yeah, just come to my office" but he's never there. […] For me, this would always be an offense - if you are not there without informing me. […] Showing me that I am the small one and I have to beg for time.*

[CMC] P8 (born in India, worked in US and UK since 22 years old): [In Paris], people come to the meeting like ten minutes late, […] and they finish the meeting half an hour later. […] I was attending meetings remotely. […] So, I go. Only the person who organized the meeting is there and people are coming at 9:10am, 9:20am, and the meeting will actually start at 9:20am. At 11am, the meeting has to finish. They continue discussing and the meeting will finish at 11:30am. […] This happened twice or thrice. I said, "Look, the meeting was till 11am, I have another meeting, so if you want my input until 11:30, make sure you set the meeting invite until 11:30." It didn't go down very well. (laughs)

On the other hand, participants who viewed appointments as "flexible" felt surprised when their partner adhered to strict timelines, especially if they perceived the timeline to be lacking in priority or importance. For example: *[FTF] P13 (India): [In India], sometimes if the meeting wasn't important, they will cancel the meeting. Even though they're ready for office, if we happen to*

encounter each other on the road, they feel free to take off from office. […] It's really different [in Switzerland]. Even for the cat feeding, they feel like it's a job.

[CMC] P25 (Mexico): In Mexico, it's always like, oh we need to make the [video] meeting with this time. Like, it's 10 o'clock, let's start for example, ten past ten. Which doesn't happen here [Switzerland] or with Japanese, I can never do that. I have to be very strict on the time.

This tension is consistent with Shachaf (2008)'s qualitative study of virtual team members who regarded the scheduling of meetings in "fluid way", arriving "late (or even very late)" to CMC meetings. Our findings also echo Reinecke et al. (2013)'s result that culture influences the amount of time people plan ahead for events using CMC tools. Our data did not support Shachaf (2008)'s finding where team members were "timelier" over CMC compared to face-to-face.

6.2.3.1. Interpretation of Cultural Dimension

Time is a non-verbal message that communicates deep cultural meanings [Hall, 1959]. One interpretation for this tension is the notion of *monochronic* versus *polychronic* time [Hall, 1959]. Monochronic time emphasizes schedules, promptness and segmentation of tasks, where time is "almost tangible", something to be "saved", "spent", or "wasted" [Hall, 1959]. Polychronic time emphasizes flexibility, spontaneity, less adherence to schedules, and is "characterized by several things happening at once" [Hall, 1959]. In many ways, "the two systems are like oil and water: they do not mix" [Hall, 1959].

6.2.3.2. Adaptations

To mitigate tensions in different cultural perceptions of appointment "fixedness", participants who viewed appointments as "fixed" adapted to be more flexible with delayed or extended meeting times. Participants who viewed appointments more flexibly adapted to be punctual and keep to the scheduled meeting time. Such adaptations were consistent in face-to-face and CMC.

Some participants who viewed appointments as "fixed" also adapted to use CMC for appointment confirmation. Confirmations were often achieved through combinations of medium to high [immediacy of feedback] media (e.g. SMS, Instant Messaging, phone) and

increased in frequency up to the time before the scheduled meeting. For example: *[CMC] P28 (Switzerland): There [India], I use WhatsApp a lot to always confirm [Skype calls]. […] I'll text, "Will you be there or will you not be there?" […] These appointments are less fixed and you have to fix it on the way.*

For such participants, CMC with medium to high [immediacy of feedback] was valued to receive prompt feedback of the likelihood of their partner's attendance. While our data indicated that media with low [symbol variety] (e.g. SMS) sufficed for appointment confirmation, more exploration is needed as to whether high [symbol variety] media (e.g. face-to-face, video) would be perceived as useful or superfluous for appointment confirmation.

On the other hand, some participants who viewed appointments flexibly adapted to use text-based CMC (e.g. SMS, Instant Messaging, email) to *manage others' expectations* of the likelihood of their appointment attendance through explicit status updates. Updates were often initiated by the person who viewed appointments as "fixed" rather than the one who viewed appointments as "flexible". For example: *[CMC] P28 (Switzerland): He [distributed colleague in India] will try to have different codes for if he will [Skype] call. Like "I will maybe call" or "let's see." And if he can't make it, he will inform me. […] Here, I think he adapted more to me, because I found it difficult to adapt. […] It is the time appointments that is a lot of disappointment and wrong expectations. […] It was very crucial for us to develop a language that we know how it is meant.*

6.2.3.3. Opportunities for technology support

One interesting direction for exploration is how technologies can mitigate communication challenges with regards to appointment "fixedness". For example, calendar tools can provide culturally adaptive visualizations [Reinecke et al., 2007] of appointment "fixedness" by adapting its interface to suit the cultural background of the user (e.g. by varying the transparency or mobility of scheduled appointments). Since people in monochronic cultures sometimes adhere strictly to schedules even when it is no longer ideal [Hall, 1959], mobile technologies with location tracking can inform both monochronic and polychronic users of emergent face-to-face opportunities that may be of higher relevance in comparison to the scheduled appointment. Technologies might also automate existing approaches used by our participants for appointment confirmation and status updates. For example, technologies can

support monochronic people in sending automatic meeting reminders to polychronic people, or support polychronic people in managing other's expectations of their appointment attendance through implicit status updates (e.g. "On the road, 40% chance will attend").

6.2.4 Tension: Task versus social orientation

Differences in task versus social-orientation emerged as an intercultural communication tension in 15 out of 30 interviews. On one side of the scale are participants who focus primarily on task accomplishment, where efficient usage of time to complete the task is valued. On the other side of the scale are participants who value social relationships, where the establishment of rapport was perceived as crucial to successful business interactions.

Different perceptions in task versus social orientation led to tensions. Task-oriented participants viewed workplace social conversation as unrelated to the task at hand and therefore an inefficient use of time. For example: *[FTF] P29 (Germany): I like to work like a Swiss watch. I don't like to spend much time on stupid, unnecessary things. […] Of course, it's nice to talk about this and that, but sometimes I have to work. I have stuff to do and I don't want to spend 10-15 minutes talking about how life is or whatever, I have to get shit done, you know?*

[CMC] P18 (Canada): With my teams in India, they want to talk about their holidays [over teleconference] for the first five minutes. […] One person wanted to talk about the latest gadget they bought for gardening and […] I was just melting, like "I don't want to talk about your garden thing for 20 minutes, I want to talk about what I need to talk to you about."

On the other hand, socially-oriented participants viewed task-focused participants as cold and antisocial. In face-to-face interactions, interpretations resulted from a lack of participation in shared social activities (e.g. coffee breaks, hallway conversations). In both face-to-face and CMC interactions, interpretations arose from a limited (or lack of) social conversation before task-based interactions. For example: *[FTF] P15 (England): There was no informal banter or chitchat. […] Classic example - we'll say, "Fancy a coffee?" and it's like, […] "No, thanks" or "I'm just going out". […] The [coffee] machine has been there for 5 months, he's never had one. […] People at my wife's company, they're the same. […] They'll go up, go the cafeteria, get a sandwich with*

them and go back to their desk and they carry on working. Brits tend not to be like that. The day passes quicker if there's social interaction.

[CMC] P25 (Mexico): [Over videoconference with a Scandinavian colleague] It was just really, extremely serious. […] Just work mattered. Like check, this, this and this. Okay, checked. Nice meeting you and ciao. I said "Hey, how are you doing? How's the weather over there?" I tried to start some conversation. He said, "Yeah, I'm fine. The weather is fine. Okay, let's move on." That was kind of shocking me. […] So I just keep on the same mood, I was also getting serious because it was also no fun in talking. Well, the job…we did it, which was important. That's it.

This tension is consistent with previous qualitative studies of social versus task-focused communication by virtual team members (e.g. [Huang & Trauth, 2007; Shachaf, 2008]), as well as lab studies of dyads communicating over Instant Messaging (e.g. [Setlock et al., 2004; Nguyen & Fussell, 2013]).

6.2.4.1. Interpretation of Cultural Dimension

One interpretation for this tension is the notion of *high-context* versus *low-context* working styles [Hall, 1976]. In a high-context team, close-knit relationships between team members, particularly when a team first forms, are essential for successful teamwork in the later stages [Laroche, 2003]. In contrast, low-context people prefer to focus on the task first and later get to know team members socially through task-related interactions [Laroche, 2003]. While high and low-context people both aim to achieve efficiency in work processes [Laroche, 2003], the different tempos in which they approach work leads to tensions. As one (higher-context) participant explains: *P21 (China): In China, if you do business with people you don't know, you want to have some social conversations in the beginning and then go to the business. […] In China, people believe that if you have good relationships with business partners, then you can be more efficient to do business. But I think here in Europe, business is business. It's not part of your social life.*

6.2.4.2. Adaptations

Over face-to-face, task-oriented participants mitigated tensions through conscious adaptations to initiate or participate in social activities (e.g. coffee breaks, dinners), both in and outside of the office. For example: *[FTF] P14 (England): This is all part of business. […] [Polish clients] like*

the idea of somebody trying to get to know them. […] If you had an hour meeting, the first maybe, even twenty minutes, could be just general chitchat. […] And then you have to work on that (laughs). Then you maybe have to offer to meet them again, and offer them for dinner or a drink, just as a gesture.

In face-to-face and CMC, task-oriented participants adapted to dedicate time and conversation content to "social" topics (e.g. family). However, since appropriate conversation topics often differed between cultures, many struggled with *what* to talk about and *how* to talk it, despite having the motivation to do so. For such participants, media with low to medium [immediacy of feedback] and high [rehearsability] was valued as it allowed time to formulate culturally appropriate conversations. For example: *[CMC] P28 (Switzerland): In [Instant Messaging] chat, it's okay because I can think about it. But when we talk on the phone, I find it difficult. […] [They talk about] how their wife is […] and that small child is walking or talking, but somehow they make a bigger story out of it, but in a nice way. […] In Switzerland, we have a strange culture with the small talk and I'm really not very good at it.*

One task-oriented participant also adapted to use higher [immediacy of feedback] and [symbol variety] media (e.g. phoning rather than using email) when communicating with more socially-oriented colleagues. For example: *[CMC] P29 (Germany): Working with Germans or Swiss, […] writing [emails] is really enough. And with the French people, […] the relationship is much more important. Like to call them, […] to ask, "How are you?", "How is your family?" […] My boss also told me, […] "Talk more to the [French] people. They will give you a faster answer. They will be more likely to help you when you need something."*

This participant would then follow up the initial (synchronous) conversation using media that supported [reprocessability] (e.g. email), to confirm a common understanding. He viewed this confirmation as important for efficient task completion, though complained that it took more time and effort.

On the other hand, in both face-to-face and CMC (text, audio and video), socially-oriented participants adapted to task-oriented people by dedicating less time and conversation content on social interactions. For example: *[CMC] P27 (China): When we write email[s] to our partners in Italy, normally we will ask, "Hey how are you doing", these kinds of things. But for Israel, we*

never say that. We just say we want to do this [task], we never show that kind of "Hi, how are you doing", that kind of thing.

Such adaptations by socially-oriented people to reduce their use of "relational communication" with task-oriented people are consistent with findings from lab-based studies (e.g. [Nguyen & Fussell, 2013, Wang et al., 2009]). While previous research indicated particular media preferences by high versus low-context people (e.g. [Kayan et al., 2006; Zakaria & Talib, 2011]), our data was inconclusive regarding media preferences due to task versus social-orientation.

6.2.4.3. Opportunities for technology support

We offer several directions for exploration with regards to addressing cultural differences in task versus social orientation. In face-to-face interactions, technologies can support social interaction by offering real-time, contextual advice for cultural behavior norms in common social contexts (e.g. coffee break, at a restaurant, at a host's home) as well as culturally appropriate conversation topics. Behavior norms and appropriate conversation topics were mentioned by the majority of participants as crucial barriers to establishing meaningful relationships. This echoes Yuan et al. (2013)'s recommendations for technologies to support "knowledge of conversational routines" and "shared activities". Text-based CMC with high [rehearsability] and [reprocessability] might support people in social conversation for *what* to talk about and templates for *how* to talk about it. CMC offering high [immediacy of feedback] might also support informal, spontaneous interactions for the purpose of developing rapport (e.g. media spaces for distributed teams [Bly et al., 1993]). For socially-oriented people, CMC tools might visualize time spent on social versus task-related conversation or augment meeting invites to provide structured agendas if meeting with task-focused professionals.

6.3 Barriers to adaptation

The previous section presented examples of mimicry adaptation – when participants successfully mimicked or copied the behaviors of culturally diverse coworkers to mitigate intercultural communication tensions. In this section, we present the barriers other participants encountered when adapting behavior. We categorize this into two themes: 1)

barriers to interpreting (decoding) interpersonal feedback and 2) barriers to adapting (encoding) behavior.

6.3.1 Barriers to interpreting interpersonal feedback

Some participants encountered barriers when decoding or interpreting the interpersonal feedback communicated by culturally diverse coworkers. Here, we refer to *interpersonal feedback* as the verbal, non-verbal or behavioral cues participants received from others, when communicating with others in face-to-face or CMC media.

Not receiving or noticing interpersonal feedback: One common barrier participants encountered when interacting across cultures is that they did not receive any interpersonal feedback from culturally diverse interlocutors or they did not notice such feedback for a long time. For example: *P26 (England): When I first started teaching with mixed cultural background students, this thing of personal space was quite new to me. [...] If I'm talking to somebody and I want to make them feel at ease, I just put my hand on their shoulder or whatever. But then, what I didn't realize that some people found that was too close, too intimate […], but often were too shy to say so. And it took me some time to realize that was the case.*

Inability to interpret interpersonal feedback: Other times, participants knew interpersonal feedback was being communicated, but was unsure exactly what the feedback was or how to decode or interpret it. To address this, some participants modified their own encoding to indicate explicitly that they were not able to interpret such feedback. For example: *P8 (India): Especially the teams from Malaysia or Asia, […] they don't say the true things on their face. So if they don't like [something], they don't say "I don't like", they will say "Okay". […] If you are in a managerial position, people won't ask questions, they won't challenge you. […] So that's why sometimes you have to go back to them and say, "Do you agree with me and do you have another opinion?" […] So it's about confirming and reconfirming.*

P20 (USA): There's a whole string of incidents like this. This kept on happening, just constantly! I mean, it's probably still happening. So I started […] telling people "I'm sorry, I'm from the East coast [USA], I don't know how to read Mid-Western signals. Please tell me if I'm doing something wrong". […] I don't know if it works. Because I've had people [say], "I kept on trying to tell her in a very clear way!" I was like

"What? I have no idea what you're talking about." According to her, she did [tell me], more than once, strongly. But from my point of view, I didn't detect anything.

6.3.2 Barriers to adapting behavior

Some participants encountered challenges when learning and adapting behavior to the encoding of a new culture. Barriers included 1) Not remembering to adapt behavior, and 2) Not knowing the specifics of how to adapt behavior.

Not remembering to adapt behavior: Some participants knew what the culturally appropriate behavior was, but did not necessarily remember to apply that behavior at the appropriate times. For example: *P28 (Switzerland): Sometimes, I even forget. I mean, I really try to always ask about their family each time. But I don't always remember. […] In the beginning, one Pakastani guy asked me, 'Have you forgotten that I have a child?' and I was like 'No, no, Sorry!' Now I think he knows. I explain to him that we don't do this here and he said 'Ok, fine.'*

P6 (Latvia): The surprising and difficult bit for me, was not to talk about my personal life at work [in Switzerland]. It absolutely, it doesn't exist at work. […]Now, I see how inappropriate it is, but it was a difficult adaptation. […] I always have to remind me that there are things I shouldn't talk about at work […], it doesn't come naturally.

Not knowing the specifics of how to adapt behavior: Some participants learned the high-level behavioral encoding they wanted to adapt to, but struggled with the low-level specifics of how to apply that behavior. In the following example, P28 knew to discuss social topics with her colleague in order to establish rapport, but struggled with knowing how exactly to do that: *P28 (Switzerland): I don't know, they just talk about their family very nicely. […]How their wife is, what she does for work, and how that small child is now walking or talking, but somehow they make a bigger story out of it but in a nice way. […]I'm stuck in this storytelling, […] I can't do it. […] I think in Switzerland, we have a strange culture with the small talk and I'm not very good at it.*

6.4 Limitations and future work

We discuss three limitations and future areas of exploration. First, in our data analysis, we coded for instances of communication challenges that participants attributed to culture as a

possible reason. Yet, factors unrelated to culture (e.g. personality, task complexity, familiarity with the medium, partner, organizational context [Carte & Chidambaram, 2004], collocated versus distributed teams [Powell et al., 2004]) also influence media selection and usage behaviors. Future work aims to tease out these layers in our data to explore the role technologies can play in facilitating intercultural communication. Second, due to scope, we did not present intercultural communication tensions that participants to attributed to language barriers. However, as language and culture are inextricably intertwined [Yuan et al., 2013], this was a commonly occurring (though separate) theme in our data, which we explore in future work. Finally, our findings provided initial insight into the complex adaptation processes people perform in face-to-face and CMC media. Future exploration is needed as to who adapts, why some adapt and not others, as well as how adaptation may change over time. Such an understanding is crucial in identifying the role that technologies can (or should) play in facilitating workplace intercultural communication.

6.5 Summary

This chapter addressed Research Questions #2 and #3. We presented findings from a qualitative study of workplace intercultural communication challenges in face-to-face and a broad range of CMC interactions. We identified four intercultural communication tensions that emerged most frequently in our dataset, including range of emotional expression, level of formality, "fixed" versus flexible appointments and task versus social-orientation. We discussed how these tensions manifested in different media, how media supported or hindered intercultural communication, as well as the successful and unsuccessful adaptations participants performed to mitigate such tensions. Based on these findings, we discussed opportunities for technology support.

This findings from this study addressed Research Question #2 – we found that the most frequently occurring intercultural communication tensions were common to both face-to-face and CMC, regardless of the medium used. While our analysis suggested that intercultural communication tensions unique to face-to-face interactions and unique to CMC do exist, such tensions were not strongly represented in the data and therefore inconclusive. These findings suggest that culture will be a persistent variable influencing workplace

intercultural communication, no matter the medium. Our findings confirmed, extended and contradicted previous work.

This findings from this study addressed Research Question #3 - we presented the mimicry adaptations some participants made to mitigate such tensions, drawing upon these adaptations as inspiration for design. We presented the barriers to adaptation other participants encountered, including barriers to interpreting interpersonal feedback and barriers to adapting behavior. Overall, this chapter contributed to a richer understanding of the communication challenges arising from national culture differences in face-to-face and CMC media, addressing Research Objectives III and IV. The next chapter will explore technology interventions to address intercultural communication challenges in CMC.

Chapter 7. Developing intercultural competence in global virtual teams[19]

Chapters 5 presented related work with relation to culture and CMC, while Chapter 6 gained a richer understanding of the intercultural communication challenges professionals experience in face-to-face and CMC media. Yet, little research has explored how CMC tools can actually mitigate intercultural communication challenges in global virtual teams. To investigate this gap, we draw inspiration from two research fields: 1) technologies for training intercultural competence, and 2) automated feedback tools to support group work. We identify unexplored directions in each field, and use this to motivate our next research question and hypotheses. To guide our design approach, we build upon the feedback method we used from Research Question #1 (attributions between native and non-native speakers).

7.1 Intercultural training technologies for developing intercultural competence

Culture is the means by which one's reality is defined [Sternberg & Grigorenko, 2004], teaching people how to think, feel, behave, and communicate with others [Neuliep, 2000]. Thus, effective communication across cultures is not an innate skill but rather a capability that is honed through time and experience [Crowne, 2008]. One approach to speed this process is to support people in developing *intercultural competence* – the awareness, knowledge and behavioral skills to interact with culturally diverse others [Hofstede, 2001]. This field of work is known as *intercultural training* (a.k.a. "cross-cultural training") - defined as "any procedure intended to increase an individual's ability to cope and work in a foreign environment" [Tung, 1981]. In

[19] Portions of this chapter are also currently in: He, H.A., Yamashita, N., Wacharamanotham, C., Schmid, J., Horn, A., Huang, E.M. 2017. Two sides to every story: Mitigating intercultural conflict through automated feedback and shared self-reflections in global virtual teams. *PACM on Human-Computer Interaction,* 1, 2, 51 (November 2017), 21 pages.

the past few decades, intercultural training has been identified as one of the key activities to improve intercultural communication effectiveness [Crowne, 2008].

Traditional intercultural training approaches include low-rigor factual methods (e.g. lectures, books), to medium-rigor analytical methods (e.g. films, cultural sensitivity training) to high-rigor experiential methods (e.g. role-playing, game-based simulations, field-trips) (e.g. [Shirts, 1977]), where *rigor* indicates "the level of the trainee's affective involvement in a training method" [Earley, 1987]. In recent years, high-rigor intercultural training approaches have begun exploring the use of technology to offer more demanding and complex educational methods [Mascarenhas et al., 2010]. We highlight two prominent approaches for intercultural training: virtual agents in 3D game environments and intelligent tutors.

7.1.1 Virtual agents in 3D game environments

Virtual humans are increasing being used as pedagogical agents, particularly for facilitating the learning of complex social or intercultural communication skills [Ogan et al., 2010]. One approach is the programming of virtual agents to exhibit culturally-realistic verbal and non-verbal behaviors, where the idea is that learners benefit through experiences in interacting with the agent [Ogan et al., 2010]. The goal is for human-agent interaction to reproduce the experience of human-human interaction, as if the learner were interacting with a person from a different cultural background. For example, researchers have implemented virtual agents that exhibit culturally realistic proxemics and gaze behaviors [Jan et al., 2007], conversation styles such as pause, overlapping speech and verbal feedback behavior [Endrass et al., 2010], speech accents [Dehghani et al., 2012] as well as postures and gestures [Rehm et al., 2009]. Figure 8 illustrates some examples. Virtual agents are often employed within the context of 3D, immersive game environments [Raybourn et al., 2005]. The ELECT-BiLAT is one example: a game-based scenario simulation teaches U.S. military forces how to conduct business negotiations and meetings in an intercultural context [Hill et al., 2006]. Scenarios place the learner in the position of a high-ranking U.S. Army officer who must solve a problem in an Iraqi community by conducting business negotiations with culturally-realistic agents exhibiting Arabic behaviors [Hill et al., 2006].

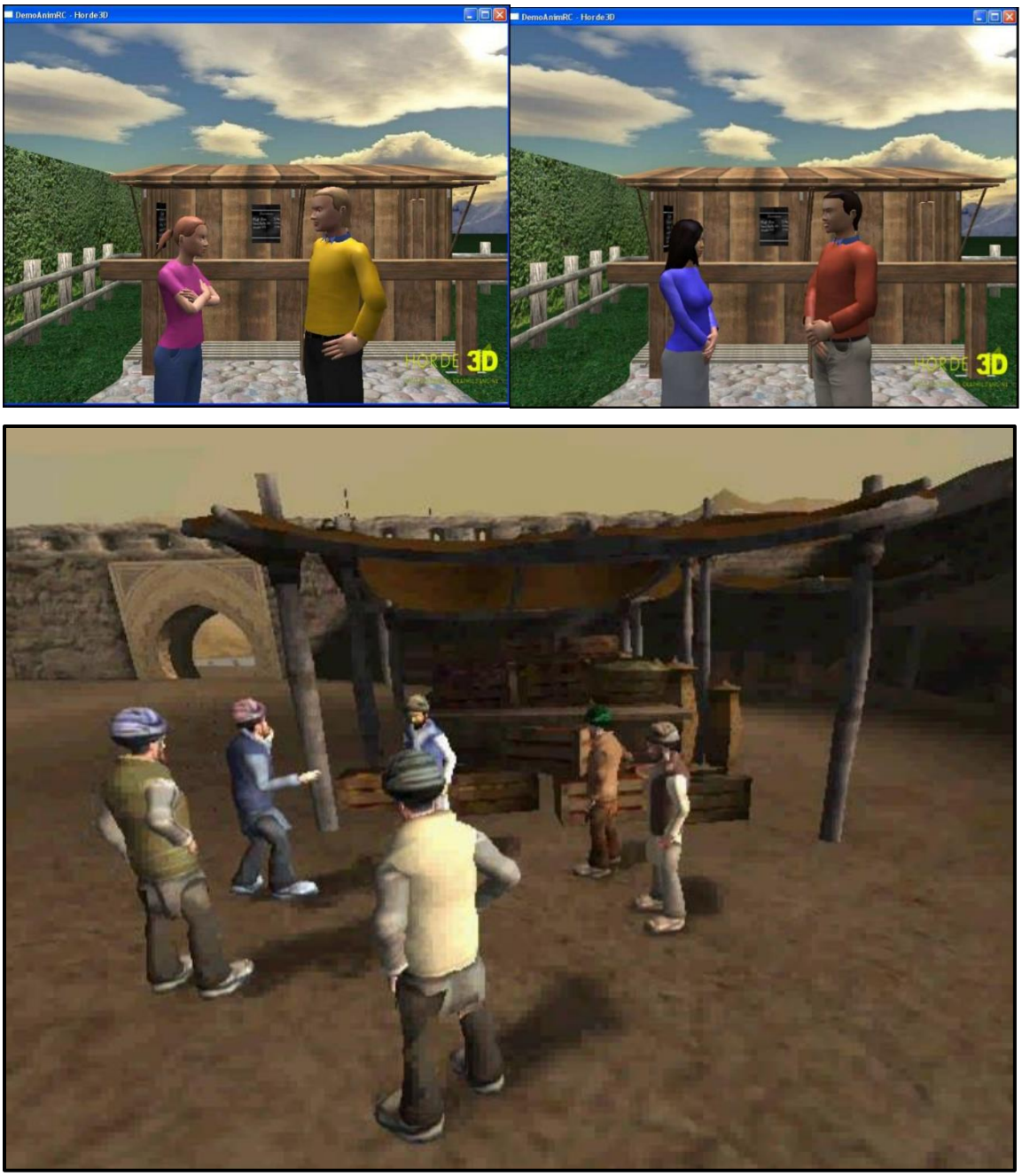


Figure 8. (Top): Endrass et al. (2009): Virtual agents representing culturally-realistic gestures and postures: German (top-left) and Japanese (top-right). (Bottom): Jan et al. (2007): Virtual agents exhibiting culture-specific gaze, proxemics and turn-taking speech behaviors.

7.1.2 Intelligent tutors

Another training approach is to combine the use of virtual agents with intelligent (pedagogical) tutors to support problem solving in complex intercultural interactions [Ogan et al, 2010]. Intelligent tutors have been employed in online classroom contexts (e.g. see [Ogan et al., 2005; Ogan et al., 2006; Ogan et al., 2008a; Ogan et al., 2008b]) or in combination with culturally-realistic agents in immersive, game environments (e.g. [Hill et al., 2006]). In contrast to virtual agents in 3D game environments (whom learners interact with), intelligent tutors guide learners in how to interact with virtual agents who exhibit culturally-realistic behaviors. Intelligent tutors compare learner actions to a computational model of "correct" and "incorrect" cultural behaviors and provide context-sensitive feedback based on those actions [Ogan et al., 2006]. Figure 9 shows screenshots of the ELECT-BiLAT simulation – in addition to interacting with a virtual agent exhibiting Arabic behaviors, learners are supported by an intelligent tutor (named "P.O."), who suggests actions and provides feedback on actions taken by the learner [Hill et al., 2006].

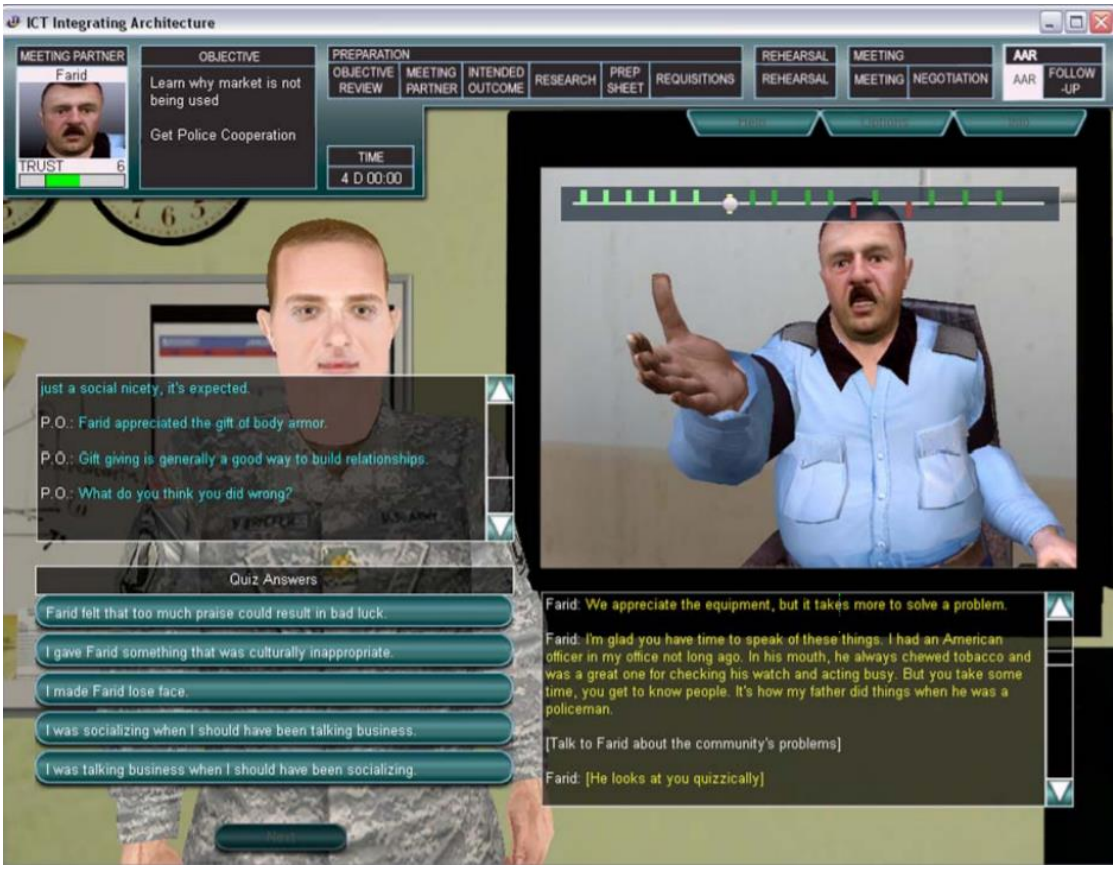


Figure 9. Kim et al. (2009): Screenshots from the ELECT-BiLAT game. (Top): Learners interact with the culturally-realistic agent ("Aziz") by choosing actions from a menu. Actions allow learners to explore a variety of negotiation strategies, where each action elicits a different response from the virtual agent, depending on whether learners took the correct action or made a "cultural error". (Bottom): "P.O." represents the intelligent tutor who guides learners in retrospective reflection on what went well or did not go well in the meeting with the virtual agent "Fand".

7.1.3 Limitations of current technological approaches to intercultural training

Current technological approaches to intercultural training offer several benefits. For learners, it provides an environment to safely explore complex intercultural situations without real-world consequences [Mascarenhas et al., 2010]. Learners can explore specific cultural actions and receive immediate feedback and guidance on those actions. For researchers, current approaches offer enhanced experimental and simulation control [Dehghani et al., 2012], allowing researchers to achieve specific educational objectives. However, such training approaches also have limitations.

First, current approaches offer training in **simulated** learning environments. While learning does occur, it is unclear how much of this learning effectively transfers to real-world intercultural contexts [Raybourn & Waern, 2004]. Second, training takes place prior to real-world interactions. This requires **dedicated time** and effort on part of the learner to complete. Third, current approaches are **culture-specific** – that is, they offer training targeted to specific national cultures (e.g. Iran). Yet, in today's globalized workplace, professionals communicate over face-to-face and in CMC with people from multiple cultural backgrounds, often in a single day. Learning content for each new national culture becomes intractable in terms of cost, time and effort. Finally, current approaches are **prescriptive** – that is, they are built upon computational models of "correct" or "incorrect" cultural behaviors. Virtual agents exhibit such culturally-realistic behaviors, while intelligent tutors guide learners in taking "culturally-appropriate" actions. This has two drawbacks. First, this approach requires that cultural theories of human behavior are sufficiently specific to allow direct translation into computational models [Aylett & Paiva, 2012]. In reality however, most theories of culture (i.e. cultural dimensions presented in Chapter 5) are too abstract for direct translation into computational models [Rehm et al., 2009] [Ogan et al., 2010], where theories that are not already sufficiently specific are simplified or omitted altogether [Aylett & Paiva, 2012]. As a result, the behaviors presented in simulated learning environments often provides a simplification of cultural behaviors and nuances. Since culture is an ill-defined and complex domain, there is a lack of consistent, unambiguous and generalizable solutions for "right" versus "wrong" behaviors [Lane & Ogan, 2009]. Prescribing "culturally-appropriate" actions based on simplified computational models might only serve to reinforce cultural stereotypes, rather than teaching learners a deeper and more nuanced understanding of culture [Ogan et al., 2010].

To address the limitations of simulated learning environments and dedicated training time, we identify an opportunity for utilizing CMC tools (i.e. existing communication channels GVTs already use) to support team members in developing intercultural competence, as they go about their daily workplace interactions. To address the limitation of prescriptive technologies, we explore the potential of CMC tools to **prompt users in reflection** of intercultural encounters. We come back to this notion of "reflection" in the next chapter,

when discussing the design of our tool. Finally, to address the limitation of culture-specific training, we draw upon the feedback method used to address Research Question #1 (the combination of automated feedback with subjective interpretations of that feedback) as a culture-general approach to intercultural training.

7.2 Automated feedback tools to support group work

To guide the design of technologies to facilitate intercultural communication, we draw upon related work in the area of automated feedback tools to support group work. Providing feedback on team behaviors is a key element in teaching collaborative skills [Bosworth, 1994]. Recent research has explored the use of sensing technologies to automatically detect and provide visual feedback on group behaviors. The goal of feedback is to help team members gain awareness of suboptimal group dynamics (e.g. imbalanced participation), and persuade members to achieve an ideal norm of effective collaboration.

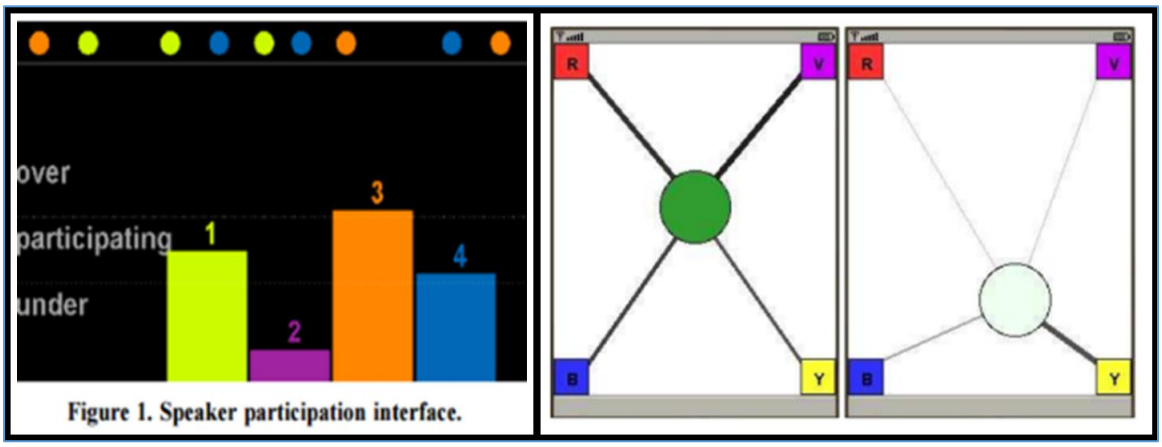


Figure 10. Examples of automated feedback tools to support group work. (Left): DiMicco et al. (2004): Feedback of group members' participation levels based on amount of works spoken, where each bar represents a person in the group. (Right): Kim et al. (2008): The squares in each corner represent people in the group. A green circle in the center represents balanced participation between team members, while a white circle towards a specific corner represents an imbalanced participation, where the person in corner "Y" dominated the discussion. Line thickness represents speaking time.

To date, the majority of this research explores face-to-face interactions in collocated teams, where automated feedback visualizes members' verbal and non-verbal behaviors (e.g. eye gaze, speaking time) with relation to group dynamics (e.g. [DiMicco et al., 2004; DiMicco

et al., 2006; DiMicco & Bender, 2007; Kulyk et al., 2005; Sarda et al., 2014]). Findings indicate feedback has been effective in encouraging reflection and motivating more balanced group participation [Reithmeier, 2013]. For example, DiMicco et al. (2004) presented a bar graph representing group members' participation based on the amount of words spoken, where team members were categorized as "over-participating", "participating" or "under-participating" (Figure 10: left). Feedback was projected on a large public display next to collocated group members sitting around a table. Kim et al. (2008) presented collocated team members a visualization representing how "balanced" and "interactive" the conversation was, based on detected speech, body movement, proximity and postures (Figure 10: right). Feedback was shown to collocated team members on individual mobile phone displays. Bergstrom & Karahalios (2007) presented collocated group members with audio feedback of member participation, where a visualization in the form of a clock represented speech activity, speaker volume, overlapping speech and silence (Figure 11). Feedback was projected onto a round table, around which team members sat.

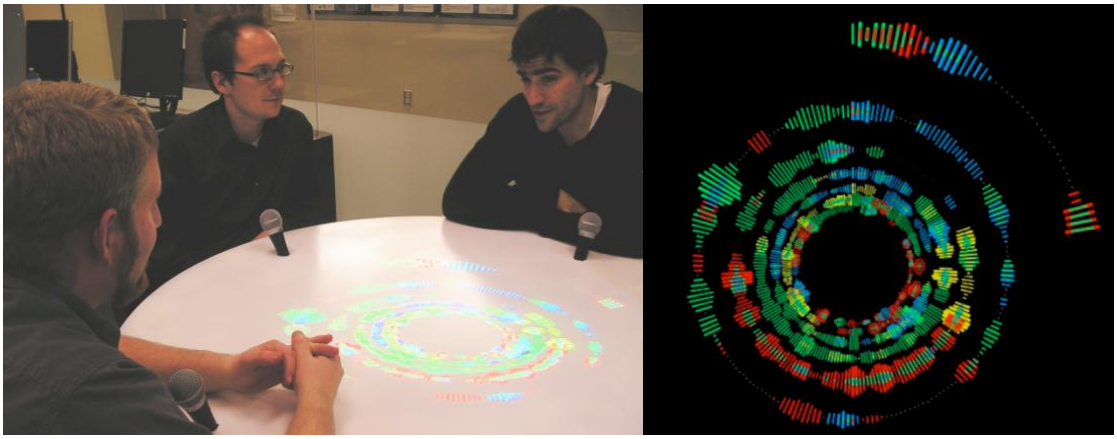
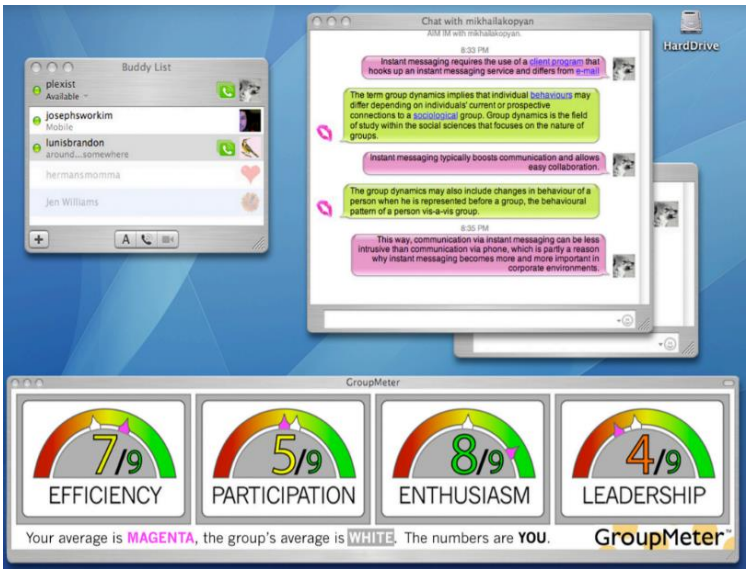


Figure 11. Bergstrom & Karahalios (2007)'s "Conversation Clock" representing audio activity of collocated group members. Each member is represented by a different color, where the length of the rectangles depicts the degree of participation based on speaker volume. A history is built with concentric rings as the conversation progresses.

While the majority of research on feedback tools to support group work have focused on collocated teams, a few studies have also explored feedback tools for distributed teams who communicate over CMC. Thus far, this research has focused on Instant Messaging (e.g. see [Leshed et al., 2009; Leshed et al., 2010; Castro-Hernández et al., 2014; Tausczik & Pennebaker, 2013]). Such studies provide feedback based on computational analysis of group

members' language usage, based on their written text in Instant Messaging conversations. Findings indicate that automated analysis of language use can reveal teamwork-relevant behaviors [Janis, 1982]. Feedback has been found to increase group members' awareness of language use, which in turn enhanced group performance [Tausczik & Pennebaker, 2013] and collaboration [Leshed et al., 2009].

For example, Leshed et al. (2010) designed a real-time feedback system called "GroupMeter" for distributed team members using Instant Messaging chat. Feedback was based on linguistic metrics of team members' language use, where the authors explored several iterations of visualization choices. The earliest iteration provided linguistic feedback with regards to the categories of "efficiency", "participation", "enthusiasm", and "leadership" (Figure 12). Later iterations explored linguistic feedback based on emotion words, word count, and self-references – linguistic metrics that correspond with team member ratings of friendliness, participation, and task-focus (Figure 12). More recent iterations explored linguistic feedback based on agreement words (to represent team cohesion) and overall word count (to represent participation) (Figure 12). The work of Castro-Hernandez et al. (2014) is another example - a real-time feedback display for Instant Messaging chats was provided to distributed team members. The display visualized group cohesion through a graph-based visualization (Figure 13), where cohesion was measured based on linguistic metrics of language similarity and member response rates.



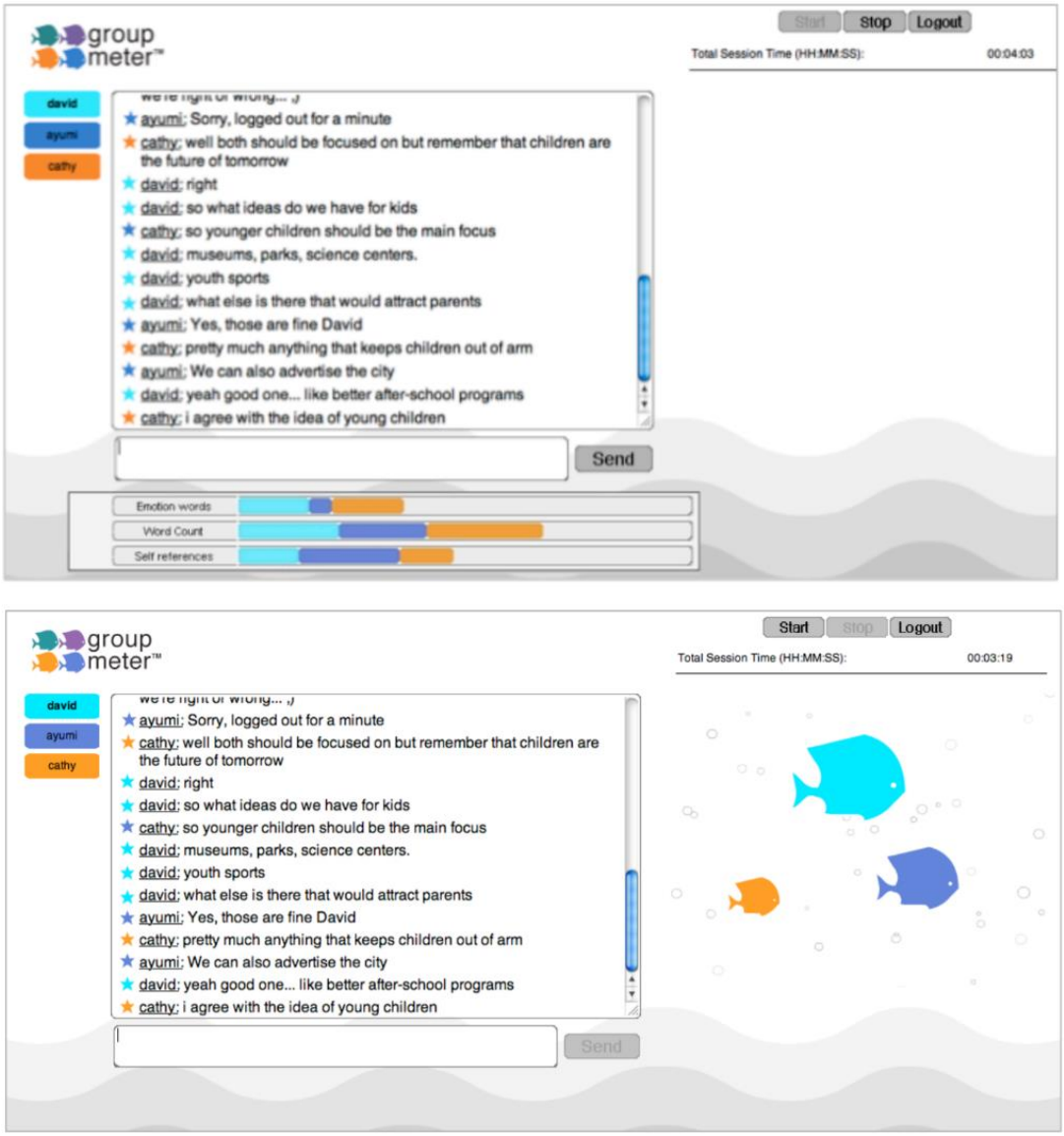


Figure 12. Iterations of GroupMeter – an Instant Messaging chat feedback system [Leshed et al., 2010]. (Top): The earliest iteration provides linguistic feedback based on categories of efficiency, participation, enthusiasm, and leadership. (Middle): A later iteration provides linguistic feedback based on emotion words, word count and self-references, represented by colored stacked bars. (Bottom): Another iteration provides linguistic feedback based on agreement words (represented by position of the fish) and word count (represented by the size of the fish).

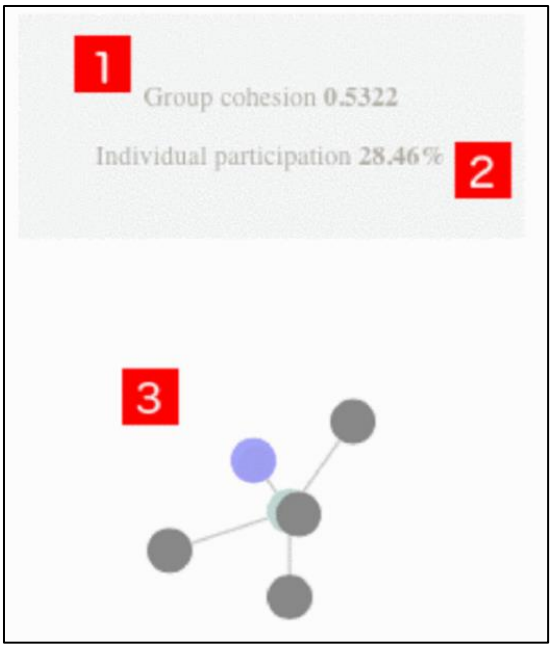


Figure 13. A feedback display representing group cohesion. The light blue circle in the center represents the project's goal, and the dark blue circle represents the user's participation. Grey circles represent the participation of team members [Castro-Hernandez et al., 2014].

7.2.1 Exploring automated feedback tools for GVTs

We believe there is potential in the use of automated feedback tools to support GVTs in developing intercultural competence. Yet, we identify two gaps in the literature. First, current studies of automated feedback tools have focused on homogeneous teams, where members come from the same national culture (e.g. American) and share the same native language (e.g. English). Second, current studies implicitly assume an ideal "norm" for effective collaboration behaviors, such as how much one should talk in a meeting or the amount of ideal eye contact. Consequently, the same feedback is assumed to be interpreted in consistent ways by all team members.

Yet, as presented in Chapter 5, national culture leads to different notions of teamwork, communication and working styles [Trompenaars & Hampen-Turner, 1998; Laroche, 2007; Hofstede et al., 2010]. For example, in the Arabic language, businesspeople who speak like poets are respected, where clever and subtle phrases are seen as the products of a cultured person [Laroche, 2007]. In contrast, in North America, most people believe in the "K.I.S.S."

style of communication (keep it simple stupid), where indirect communication is seen as "beating around the bush, wasting time, and risking clarity" [Laroche, 07]. Consequently, GVTs who comprise members of different national cultures may not hold a single ideal "norm" for collaboration, where culturally diverse members may interpret the feedback in significantly different ways.

7.3 A design approach: Feedback interventions to develop intercultural competence

To address the gaps in current research, we propose a new design approach to support GVTs in mitigating intercultural communication challenges. Specifically, we build upon the feedback method used in Research Question #1 – that is, the combination of automated quantitative feedback of team members' behaviors, along with members' subjective interpretations (self-reflections) of that feedback which was shared among group members. While Research Question #1 used this feedback as a research **probe** to elicit attributions between native and non-native speakers, in this chapter, we explore the potential of feedback as an **intervention** to support culturally diverse team members in developing intercultural competence. In contrast to Research Question #1 which explored the combined effect of automated feedback with shared self-reflections, in this chapter, we investigate the impact of [no feedback] versus [automated feedback] versus [automated feedback with shared self-reflections]. We propose three hypotheses.

First, we believe automated feedback of team members' behaviors will increase members' awareness of cultural differences, thereby increasing intercultural competence. Shared self-reflections of that feedback may encourage understanding of cultural differences, potentially further increasing intercultural competence. Thus, we hypothesize:

H1: Compared to [no feedback], [automated feedback] will increase GVT members' **intercultural competence**. Assuming the previous is true, [shared self-reflections] with [automated feedback] will lead to higher intercultural competence, compared with only [automated feedback].

Second, previous work found that automated feedback can lead members to compare self with others, which may motivate members to become more similar to each other with regards to detected behaviors in the automated feedback [e.g. He et al., 2017, DiMicco & Bender, 2007a]. We believe adding shared self-reflections may promote understanding of why other members behave in certain ways, potentially further increasing similarity between members. Thus, we hypothesize:

H2:	Compared to [no feedback], [automated feedback] will lead culturally diverse GVT members to become **more similar** with regards to **detected behaviors** in the automated feedback. Assuming the previous is true, adding [shared self-reflections] to [automated feedback] will lead members to become more similar, compared with only [automated feedback].

Third, by promoting understanding of each other, we believe automated feedback may also lead members to become more receptive to different ideas or perspectives provided by other members. Shared self-reflections may further increase openness to different perspectives, since it can reveal others' internal reasoning or explanations. Thus:

H3:	Compared to [no feedback], [automated feedback] will lead GVT members to be **more receptive** to different ideas or perspectives offered by other members. Assuming the previous is true, adding [shared self-reflections] to [automated feedback] will increase receptivity, compared with only [automated feedback].

Finally, since culturally diverse teams experience higher levels of interpersonal conflict [Hinds & Mortensen, 2005; Leung & Wang, 2015] compared to homogenous teams, we explore the effect of feedback on group members' perceptions of intercultural conflict. We ask the exploratory research question:

Research Question #4:	How does [no feedback] versus [automated feedback] versus [automated feedback with shared self-reflections] influence group members' **perceptions of intercultural communication challenges**?

The next chapter presents an experiment to address these hypotheses and research questions.

7.4 Summary

This chapter explored approaches for the design of support tools to mitigate intercultural communication challenges in GVTs. We drew inspiration from two research fields: 1) technologies for training intercultural competence, and 2) automated feedback tools to support group work. We identified gaps in current literature, and built upon our methodology from Research Question #1 to identify hypotheses *H1, H2, H3* and Research Question #4. The next chapter addresses these hypotheses and research question through a mixed-methods experiment with 30 Japanese-Canadian dyads who completed a negotiation task over email.

Chapter 8. Investigating feedback interventions in global virtual teams[20]

This chapter addresses *H1, H2, H3* and Research Question #4, which contribute towards Research Objective V.

H1: *Compared to [no feedback], [automated feedback] will increase team members'* ***intercultural competence****. Assuming the previous is true, [shared self-reflections] with [automated feedback] will lead to higher intercultural competence, compared with only [automated feedback].*

H2: *Compared to [no feedback], [automated feedback] will lead culturally diverse team members to become* ***more similar*** *with regards to* ***detected behaviors*** *in the automated feedback. Assuming the previous is true, adding [shared self-reflections] to [automated feedback] will lead members to become more similar, compared with only [automated feedback].*

H3: *Compared to [no feedback], [automated feedback] will lead members to be* ***more receptive*** *to different ideas or perspectives offered by other members. Assuming the previous is true, adding [shared self-reflections] to [automated feedback] will increase receptivity, compared with only [automated feedback].*

Research Question #4: *How does [no feedback] versus [automated feedback] versus [automated feedback with shared self-reflections] influence group members'* ***perceptions of intercultural conflict****?*

To address these hypotheses and questions, we conducted a mixed-methods experiment with 30 Japanese-Canadian dyads who completed a negotiation task over email. Dyads were assigned to one of three conditions: C1) no feedback; C2) automated language feedback of participant emails based on national culture dimensions; and C3) automated language feedback

[20] Portions of this chapter are also currently in: He, H.A., Yamashita, N., Wacharamanotham, C., Schmid, J., Horn, A., Huang, E.M. 2017. Two sides to every story: Mitigating intercultural conflict through automated feedback and shared self-reflections in global virtual teams. *PACM on Human-Computer Interaction,* 1, 2, 51 (November 2017), 21 pages.

(as in C2), with participants' shared self-reflections of that feedback. Results show Japanese and Canadian partners interpreted the negotiation task differently, resulting in perceptions of intercultural conflict and negative impressions of their partner. Compared to C1, automated language feedback (C2) and shared self-reflections (C3) made cultural differences more salient, motivating participants to empathize with their partner. Shared self-reflections (C3) served as a meta-channel to communication, providing insight into each partner's intentions and cultural values. We discuss implications for CMC tools to mitigate perceptions of intercultural conflict. In this chapter, we present the methodology and findings. Following this, we discuss opportunities for technology support. We conclude with limitations and future work, and a summary of this chapter.

8.1 Methodology

To investigate *H1, H2, H3* and Research Question #4, we conducted an experiment with 30 Japanese-Canadian dyads who completed a negotiation task over email. Using a between-subjects design, participants were randomized into one of three conditions: Condition 1 - **N**o feedback (N); Condition 2 - automated language feedback in the form of **G**raphs (G); and Condition 3 - automated language feedback in the form of **G**raphs and shared self-**R**eflections (G+R). Supplementary materials regarding Methodology are presented in Appendix C of this dissertation.

8.1.1 Participants

Dyads were used in this experiment since two-person groups are frequently used for collaboration and negotiation tasks in organizational life [Topi et al., 2002]. In negotiations, even if more than two people are involved, leaders of negotiation parties represent their groups and take on distinctive roles during the negotiation process, which are often dyadic in nature [Topi et al., 2002]. Dyads were composed of Japanese-Canadian pairs. We chose Japan and Canada since these countries differ significantly on national cultural dimensions such as power distance, individualism versus collectivism, masculinity versus femininity, and short-term versus long-term orientation [Hall, 1976; Hofstede et al., 2010]. These differences reflect contrasting cultural values, which in turn, may increase the potential for intercultural conflict.

We recruited 60 participants: 30 Japanese (15 f), and 30 Canadian (15 f). Participants were undergraduate university students whose birth country is Japan or Canada, who currently reside in their birth country and who have never lived outside of their birth country for more than one year. The mean age of Japanese participants is 21.3 (SD=1.35) and Canadian participants is 21 (SD=1.83). The experiment was advertised to participants as an exploration of "how email tools can support communication between people from different cultural backgrounds". Participants were told they would be "completing a decision-making task with a partner from [Japan/Canada] over email", where their conversations would be "analyzed by a text analysis tool". Dyads took between one to three weeks to complete the task and were compensated a monetary amount equivalent to 75 USD. All experiment documents were in English.

8.1.2 "Cognitive conflict" Negotiation Task

Task Type: The type of task being performed significantly impacts the nature of group processes [Mennecke et al., 1993; Straus, 1991]. We chose a task type which would increase the likelihood of encountering intercultural conflict. Based on McGrath's Task Circumplex Model [McGrath, 1984], we chose a "cognitive conflict" negotiation task, where group members must work interdependently to resolve conflict in viewpoints (i.e. values and attitudes) [McGrath, 1984]. This type of task has no objective "correct" answer [McGrath, 1984], where high interdependence evokes increased exposure to the knowledge and perspectives of other team members [Leung & Wang, 2015], potentially increasing intercultural conflict.

Negotiation task: We adapted the Legislative Dilemma Task [Mennecke et al., 2000] – a "cognitive conflict" negotiation task where group members must allocate $1.8 million among five competing social programs. Participants were told to act as the "financial representatives" for a global philanthropic organization called "Envision Change International". Japanese and Canadian partners represented the Japanese and Canadian headquarters respectively, where both partners held the "same status and decision-making power".

Participants could choose from five social programs: 1) Prevention and punishment for high-school bullying, 2) Regulations about workplace overtime, 3) Rehabilitation programs for

drug addiction, 4) Integration of immigrants and refugees, and 5) Robots to take care of the elderly. Participants were told that if a program is selected, "funding will be split equally between Japan and Canada". Programs were chosen based on pilot testing of current social issues that were potentially relevant to Japan (programs #2,5), Canada (programs #3,4), or both (program #1).

Participants were told to communicate their "initial funding proposal" to their partner over email, where the goal is to "convince your partner that your proposal is the best option", based on your "personal beliefs and values". By the end of the task, "you and your partner should come to an agreement of fund allocation that you are both happy with". Funding constraints meant that participants can choose at most two social programs, where the first program receives more money than the second.

We chose email for several reasons. First, distributed teams are increasingly choosing email as a channel for negotiation [Thompson & Nadler, 2002; Rossette et al., 2012]. Second, email is asynchronous and text-based, allowing non-native speakers (i.e. Japanese participants) more time to comprehend foreign speech and plan, produce and edit their own [Kitade, 2006]. Finally, email allowed us to overcome time-zone differences between Japan and Canada.

Dyad composition: To ensure dyads would have something to negotiate, we paired Japanese-Canadian partners who chose different social programs (regardless of whether the programs they picked were consistent with our expectations of Japanese or Canadian preferences). Dyads were randomized across conditions to achieve an equal balance of same-gender and mixed-gender groups.

Task Instructions: Each partner was asked to write 4 emails (in total) to complete the task, with each email containing at least 1-2 paragraphs to ensure enough text to analyze, and to CC a researcher email account for every email. We instructed Canadian participants to write the first email. This decision was made after pilot testing, where Japanese participants expressed they were hesitant and uncomfortable to initiate negotiations in a foreign language.

Pilot testing of social programs: Pilot testing of social programs began with discussions about current social issues with contacts who live in Canada or Japan. From this, we generated an initial list of social programs and asked recruited participants to rank programs in order of

personal importance. Based on these results, we removed programs that did not evoke diverging opinions between Canadians and Japanese (e.g. "gender equality in the workplace") and programs which required additional research or technical expertise (e.g. "Phase-out of nuclear power plants").

8.1.3 Automated Language Feedback (Graphs)

While Condition 1 (N) provided no feedback, participants in Condition 2 (G) and Condition 3 (G+R) were provided with automated language feedback (**G**raphs). We first introduce a framework of intercultural competence, which we used to guide our design of the graphs.

8.1.3.1. Cultural Intelligence (CQ) framework

The *Cultural Intelligence* (CQ) framework defines four intercultural competences: Cognitive, Metacognitive, Behavioral and Motivational that are transferable across different cultural contexts (Table 6) [Ang et al., 2007]. These four competences are articulated as a form of intelligence, where *intelligence* is defined as the "ability to learn" [Sternberg & Grigorenko, 2006]. Unlike personality traits which reflect "preferred ways of being" that remain relatively stable over time [Ng & Earley, 2006], CQ competences reflects a set of "relatively malleable capabilities" comprising mental, motivational and behavioral components that can be developed and enhanced over time through intervention and experience [Ng & Earley, 2006]. In recent years, the CQ framework has gained significant recognition, moving from an academic construct to a practical framework used by industry leaders for intercultural education [Ng et al., 2012]. We use this framework to guide the design of our feedback.

Cognitive CQ: Knowledge of basic frameworks of cultural values (cultural dimensions).
Metacognitive CQ: Consciousness and awareness of the cultural knowledge one applies in intercultural interactions.
Behavioral CQ; The capability to exhibit situationally-appropriate behaviors in culturally diverse situations.
Motivational CQ: Directing and motivating attention and energy to adapt in new cultural settings.

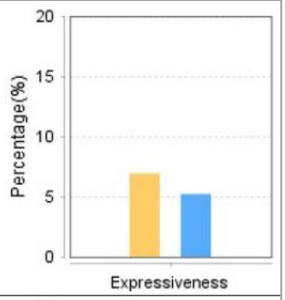
Table 6. The Cultural Intelligence (CQ) Framework.

8.1.3.2. Graphs of Cultural Dimensions

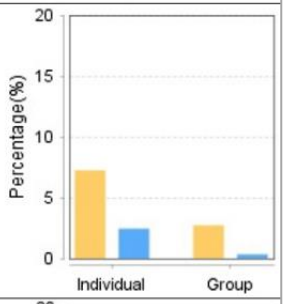
Automated language feedback was provided in the form of bar graphs, which visualized participants' language usage in relation to cultural dimensions (Figure 14). We chose five cultural dimensions that differ between Canada and Japan: Emotional Expressiveness [Laroche, 2003], Individual-Focus or Group-Focus [Hofstede, 2001, Ting-Toomey, 2012], Level of Relationship-Focus [Hall, 1976], Short-term or Long-term Focus [Hofstede, 2001] and Level of Informality [Hofstede, 2001]. Bar graphs compared Japanese (orange) and Canadian (blue) partners beside one another. To support participants in developing Cognitive CQ, we provided a brief definition of each cultural dimension (based on cultural anthropology literature) alongside every graph. We intentionally did not indicate how Japan and Canada compare on such dimensions, in order to evoke reflection (Metacognitive CQ) of one's own cultural values compared to their partner's. Participants were told that "*each graph reflects common differences in communication styles between different cultures*", though "*the graphs can be affected by other factors such as personality, mood, environment, language fluency, etc."*

Graph feedback was provided in two rounds: Round 1 feedback was calculated based on each partner's first and second emails, and provided after both partners wrote their second email. Round 2 feedback was calculated based on each partner's third and fourth emails, and provided after both partners wrote their fourth and final email. Participants received both rounds of feedback as an attached PDF.

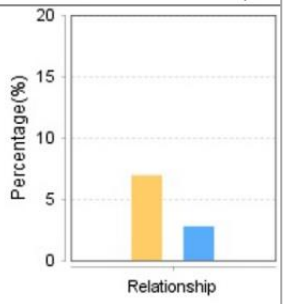
Emotional Expressiveness: Emotional expressiveness can vary greatly between cultures. Some cultures do not tend to express significant positive or negative emotions, where being able to control the display of one's emotions is highly valued. Other cultures tend to freely express both positive and negative emotions, where consistency between what one feels and what one displays is valued.



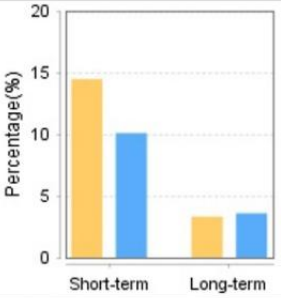
Individual or Group Focus: Cultures differ with regards to whether the interest of the group is more important than the interest of the individual. In individual-focus cultures, people are expected to take care of only themselves and their immediate families. In contrast, in group-focus cultures, people expect their relatives or members of a particular in-group (e.g. extended families, companies) to look after them.



Level of Relationship Focus: Cultures differ in terms of working styles. Relationship-focused cultures prefer to develop close-knit relationships between team members, believing that close relationships are essential for successful teamwork. In contrast, task-focused cultures prefer to focus on the task and get to know team members socially through task-related interactions. Such cultures do not necessarily believe close relationships are mandatory to achieve the task effectively.



Short-term or Long-term Focus: All cultures have to maintain some links with its own past while dealing with the challenges of the present and the future. Cultures prioritize these two goals differently. Short-term focus cultures tend to value the importance of profits of the current year. In contrast, long-term focus cultures tend to value the importance of profits 10 years from now.



Level of Informality: Cultures differ in how formal or informal communication is. Hierarchical cultures may use more formality, depending on the relationship between two people. Egalitarian cultures may use less formality (in other words - be more informal), regardless of the relationship between two people.

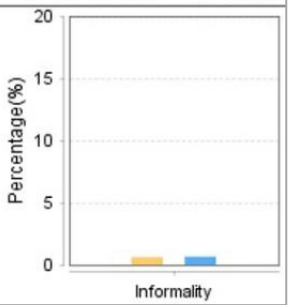


Figure 14. Example of automated language feedback (graphs of cultural dimensions) from Condition 3. Orange represents the Japanese partner. Blue represents the Canadian partner.

Text-Analysis Tool: For text-analysis of participant emails, we used the Linguistic Inquiry and Word Count (LIWC) [Pennebaker et al., 2015] and the accompanying API[21]. LIWC offers 80 categories of content and function words, which reflect psychological processes [Tauszcik & Pennebaker, 2010]. It is one of the most commonly used and well-validated tools for computational linguistic analysis [Tauszcik & Pennebaker, 2010].

Calculations for each graph are shown in Table 7. Underlined words represent LIWC category names, which are in percentage values. The LIWC category of "Dictionary words" reflects the percentage of recognized dictionary words. All graphs represent relative rather than absolute values. Since non-native speakers experience a higher cognitive load due to language barriers [Takano & Noda, 1993] and typically write less than native-speakers [Barner-Rasmussen & Björkman, 2007], relative values allowed us to compensate for differences in email length.

Since the literature linking LIWC categories to cultural dimensions is sparse, our decisions of which LIWC categories map to which cultural dimensions are a rough measure based on cultural dimension definitions and LIWC category names. For example, since short-term focus cultures value the here and now, while long-term focus cultures value the past and future [Bearden et al., 2006, Hofstede et al., 2010], we refer to the LIWC category of "present focus" (e.g. today, is, now) as a measure for *short-term focus*, and the LIWC categories of "past focus" (e.g. ago, did, talked) and "future focus" (e.g. may, will, soon) as a measure for *long-term focus*. One related work exception that directly maps LIWC categories to cultural dimensions is for the *individual versus group-focus* graph. *Individual-focus* cultures (also known as "individualistic cultures") can be characterized by self-attentional focus and can be assessed by the LIWC category of "first-person singular pronouns" (e.g. I, me, mine) [Na & Choi, 2009; Tausczik & Pennebaker, 2010; Yu et al., 2016]. In contrast, group-focus cultures (also known as "collectivistic cultures") can be characterized by other-oriented attentional focus which can be assessed by the LIWC category of "first-person plural pronouns" (e.g. we, us, our) [Na & Choi, 2009; Tausczik & Pennebaker, 2010; Yu et al., 2016]. The LIWC categories we chose are by

[21] Receptiviti API. http://www.receptiviti.ai/

no means exhaustive, but rather represent a sampling of language use (and in turn, graph feedback), which we believed might elicit different interpretations by Japanese and Canadian participants.

Graph 1	Emotional Expressiveness = (Positive emotion + Negative emotion) / Dictionary words
Graph 2	Individual-Focus = First person singular pronoun / Dictionary words
	Group-Focus = First person plural pronoun / Dictionary words
Graph 3	Relationship-focus = (Social processes + Leisure + Home + Affiliation) / Dictionary words
Graph 4	Short-term Focus = Present focus / Dictionary words
	Long-term Focus = (Past focus + Future focus) / Dictionary words
Graph 5	Informality = Informal language / Dictionary words

Table 7. Calculations for graph feedback, based on LIWC categories.

8.1.4 Shared Self-reflections (of the graphs)

After seeing the graphs, participants in Condition 3 (G+R) were also asked to fill in a self-reflection, which they were told would be shared with their partner. The self-reflection asked participants to "*reflect upon your own behavior in comparison to your partner*". Each graph offered an example prompt, though participants were told they could write freely. An example prompt for "Emotional Expressiveness" graph: "*My expressiveness was lower than my partner because*….". An example prompt for "Level of Informality" graph: "*My informality was higher than my partner because*…". The shared self-reflections aimed to support participants in developing Metacognitive CQ through active reflection of one's own graphs (which reflect national culture values) in comparison to their partner.

8.1.5 Metacognitive CQ

The authors of the CQ Framework argue that Metacognitive CQ should be one of the central focuses in intercultural education [Ang et al., 2007; Van Dyne et al., 2008], providing three

reasons. First, Metacognitive CQ promotes active thinking about people and situations when cultural backgrounds differ. Second, Metacognitive CQ triggers critical thinking about habits, assumptions, and culturally-bound thinking. Third, Metacognitive CQ allows interlocutors to evaluate and revise their mental maps, consequently increasing the accuracy of their cross-cultural understanding.

Using the Cultural Intelligence Scale (CQS) [Van Dyne et al., 2008], participants in all conditions self-rated their Metacognitive CQ before and after the task, where changes in self-ratings reflect how the task experience influenced participants' self-perceptions of their Metacognitive CQ. Responses in the CQS are recorded on a scale of 1 = "Strongly disagree" to 7 = "Strongly agree". Questions for Metacognitive CQ are listed in Table 8.

I am conscious of the cultural knowledge I use when interacting with people from different cultural backgrounds.
I adjust my cultural knowledge as I interact with people from a culture that is unfamiliar to me.
I am conscious of the cultural knowledge I apply in cross-cultural interactions.
I check the accuracy of my cultural knowledge as I interact with people from different cultures.

Table 8. Metacognitive CQ questions: Self-report responses are recorded on a scale of 1 (strongly disagree) to 7 (strongly agree).

8.1.6 Semi-structured interview

After finishing the post-task questionnaire, participants in all conditions were interviewed individually in their native language by a researcher of the same cultural background. Interviews took place over Skype audio and lasted between 20 to 50 minutes. All interviewers followed the same protocol. Questions common to all conditions include participants' experience with the task and with their partner, perceived differences in communication styles, communication challenges (if any) during the task, and learnings (if any) about their partner or their partner's culture. Condition 2 and 3 interviews explored additional questions regarding participants' impressions of the graphs in Round 1 and Round 2. Condition 3 interviews explored questions regarding participants' experiences of writing the self-reflection and reading their partner's self-reflection.

Interviews were partially transcribed. Using inductive qualitative methods [Corbin], the first author (Chinese-born Canadian) and second author (Japanese) independently created two affinity diagrams based on the Canadian and Japanese interview data respectively. For each affinity diagram, the assigned author inductively generated high-level themes and relationships between the themes, in the language the interview was conducted in. Next, Japanese themes and participant quotes were translated into English. Finally, all authors collaboratively discussed the high-level themes to iteratively refine the codes. The findings below emerged from this collaborative analysis.

8.2 Findings

We first identify three areas of intercultural conflict, perceived by participants across all conditions. Next, we address *H1*, *H2*, *H3* and Research Question #4 by discussing the impact of Condition 2 (G) and Condition 3 (G+R) feedback. We illustrate using participant interview quotes, which we refer to by condition, group number, and nationality where "CA" stands for Canada, and "JP" for Japan (e.g. C2-G18-JP).

8.2.1 Areas of Intercultural Conflict

Japanese and Canadian participants approached the negotiation task differently, leading to three areas of perceived intercultural conflict. We contrast Canadian and Japanese perspectives below, and conclude with possible interpretations of our findings.

8.2.1.1. Conflict #1: Difficulty with Perspective-Taking

Both Canadian and Japanese participants picked programs relevant to their own cultures, and expressed an initial difficulty in relating to their partner's program choices. For example, Canadian participant C1-G2-CA said: *"[Our choices] were directed towards our own experiences. I didn't think 'workplace overtime' and 'robots' applied too much to Canada. At the same time, they didn't think that 'refugees' or the 'drug' one applied much to Japan".*

C1-G4-CA: "One thing I didn't realize is that workplace overtime has become such a big deal in Japan. That people commit suicide over it. […] That's something that really shocked me and not something I would have expected."

From the Japanese perspective, C3-G22-JP: *"We're from different environments, so we have different perspectives. I felt a cultural difference. Sometimes we don't know the background knowledge. Things that are common in Japan aren't common in Canada, and vice versa."*

C1-G6-JP: "I've never thought about these issues deeply – for instance, I didn't think about refugees at all. I chose social programs only based things happening around me."

8.2.1.2. Conflict #2: Asymmetry in Perception of Communication Style Differences

Participants differed in perceptions of communication style differences between them and their partner. Canadians perceived little to no difference, while Japanese perceived many differences and mimicked their partner to adapt to those differences. We present details below.

Before the task, most Canadian participants expected language barriers. Yet, many were surprised by the English fluency of their Japanese partners, perceiving little to no communication style difference between themselves and their partner during the task. For example, C2-G14-CA: *"It seemed like she was somebody either from Canada or the US. Her English writing skills are pretty good".*

C2-G13-CA: *"I was surprised we had a very similar tone. If I didn't know, I wouldn't have noticed it was someone from a totally different country".*

In contrast, Japanese participants perceived numerous communication style differences compared to their partners, such as email structure, writing style, and negotiation style. For example, C1-G10-JP: *"In Japanese emails, we write 'Dear…' and our name again before starting the main text. But in foreign emails, they write 'Dear...' and only their first name at the very end. In Japanese emails, we'd write our full names and affiliation at the end".*

C1-G4-JP: "*They write conclusions first, then details like examples and reasoning. [In Japan, it's the opposite]. I thought this style is easy for debating, […] for conveying one's opinion. I think this is a cultural thing – a general style of writing in their culture."*

Upon perceiving style differences, Japanese participants would often "mimic" their partner's writing style. For most participants, comprehension of their partner's message was not a problem. However, all Japanese participants expressed challenges with writing and being able to clearly articulately their thoughts. Consequently, many participants would mimic their

Canadian partner's writing style, with the intention to reduce language and cultural misunderstandings. For example, C1-G5-JP: *"My partner is a good writer. […] So I mimicked his structure and wrote opinions in a similar way. Because we're communicating in English, I should adapt. I'm not used to writing in English, so I should mimic my partner's writing style."*

C1-G6-JP: "*My partner's message looked like it followed some kind of format - program name, fund amount, reason. He also wrote 'Hello' in the beginning and 'Regards' at the end. […] I mimicked his style because there's a language barrier – in order to reduce misunderstanding".*

8.2.1.3. Conflict #3: Different Negotiation Styles

Canadian and Japanese participants differed significantly in how they approached the negotiation task. Canadian participants expected a back-and-forth discussion of funding allocations as each partner put forth their own opinions. Many were surprised when their Japanese partners yielded easily without an engaging discussion. For example, C3-G22-CA: *"In her second email, she said 'Okay let's go with your idea'. I was really confused because I thought we were supposed to actually argue. […] She was really fast to agree! […] She was like, 'Oh, that's a problem I didn't know about, so yeah, let's go for it'".*

C1-G10-CA: "*He went along with everything I said. He wasn't very critical I guess. […] I'd rather he have more conflicts, I'd prefer if he had stronger beliefs or ideas".*

In contrast, Japanese participants interpreted the negotiation task as coming to an agreement, where both partners would yield and accommodate the other. Many participants were concerned that since English is not their native language, the "*nuance*" of their message may be lost, where the "*tone*" of their message may seem "*abrupt*", "*impolite*" or "*aggressive*". For example, C2-G12-JP: "*I'm not used to communicating in English. I was worried if the nuance was properly conveyed".*

C2-G16-JP: *"I wished I knew how to say things more softly [in English] – be able to adjust the tone of my arguments. I don't want to give the impression that I'm an insensitive person who can't read the atmosphere".*

C2-G18-JP: "*I can't see his facial expressions or his reactions. So I don't know what he's really thinking. I was concerned my partner might think I'm a pushy person".*

On the contrary, Japanese participants were surprised at how directly Canadian partners stated their opinions, perceiving their partner to be "*headstrong*" and "*inflexible*". For example: C1-G7-JP: *"I was shocked to see how strongly my partner stated her opinion. It must be the norms of overseas - not just Canada but globally. I think she wanted to have a debate, but I wanted to come to an agreement. I think it's meaningless to just give opinions".*

C2-G12-JP: *"I got the impression my partner is a straightforward person. I think it's an English way of writing things. […] It's totally not a Japanese way. They don't accommodate their opinions to other people".*

More specifically, Canadian and Japanese participants differed in how they managed conflicting viewpoints during the task. Canadians expected their Japanese partner to directly address points they did not agree with and felt irritated when they did not. In contrast, Japanese participants intentionally avoided direct disagreement or conflict with their partner's opinions, preferring instead to implicitly disagree by proposing their own viewpoints. We present examples from both perspectives: C1-G7-CA: *"My first email was outlining my proposal and why I chose it. They responded the same way, but they didn't touch on anything I had mentioned. A lot of the conversation was trying to evoke more in-depth answers from them. […] It almost seemed like I was pushy with my ideas, just because I was trying to push the conversation forward."*

C2-G18-JP: "*I wrote my opinion but rarely commented on my partner's opinion. Because I didn't know how to react to his opinion. I didn't want to refute his points since I didn't want him to feel bad, but I didn't agree either."*

8.2.2 Possible Interpretations for 'Areas of Intercultural Conflict'

Conflict #1: We offer a few possible interpretations. First, language barriers may have contributed to perspective-taking difficulties, where Japanese participants were not able to fully convey or justify their arguments. Another explanation may be that GVT members often fail to communicate critical information about their local situations, where distributed members lack an understanding of each other's situations [Cramton, 2002]. An alternative interpretation is the different ways Westerners and East Asians perceive the world [Nisbett & Miyamoto, 2005]. East Asians place greater attentional resources on contextual (environmental) information, while Westerners attend to object features and characteristics

[Nisbett & Miyamoto, 2005]. Cultural differences in attentional focus may have contributed to difficulties in perspective-taking, where Canadians and Japanese justified their program choices based on the relevant attentional focus in their own culture.

Conflict #2: Japanese participants perceived numerous communication style differences and mimicked their partner's emails, leading Canadian participants to perceive few style differences. One interpretation is that Japanese participants were motivated to mimic their partner to avoid possible misunderstandings due to foreign language use, self-perceived lack of proficiency in English, or cultural barriers. Another interpretation may be since Canadian partners always initiated the conversation, mimicking an existing template may have easier for the receiving partner than writing a new email. In either case, mimicking made differences in communication styles less salient for Canadian participants.

Conflict #3: One interpretation may be due to cultural styles of negotiation. Collectivistic cultures (e.g. Japan) emphasize an interpersonal, relationship-based negotiating style [Adler, 1997; Graham et al., 1994]. Face-saving and direct conflicts are avoided [Graham et al., 1994], where Japanese negotiators are reluctant to turn down a proposal explicitly [Graham et al., 1994]. In contrast, individualistic cultures (e.g. Canada) appeal to logic and 'objective' facts during negotiations [Adler, 1997], valuing direct communication and assertiveness [Zhenzhong & Jaeger, 2010]. These differences, along with language barriers, may have contributed to conflicting negotiation styles in our experiment.

8.2.3 The Impact of Feedback on *H1, H2, H3*, Research Question #4

We first present quantitative results to address *H1, H2,* and *H3*. Next, we present qualitative findings to address Research Question #4.

8.2.3.1. Quantitative Results

Analysis method for *H1*: To investigate *H1,* we measure the notion of "intercultural competence" using Metacognitive CQ. To investigate the effect of experiment conditions on Metacognitive CQ, we conducted confirmatory contrast analysis for each nationality. We compared Condition 1 (N) versus Condition 2 (G) and Condition 3 (G+R); as well as Condition 2 (G) versus Condition 3 (G+R) (6 pairs in total). To control the family-wise error

rate (FWER) a = .05, we used single-step adjustment based on a joint t-distribution. Below, we report *Mean* ± 95% confidence intervals (CIs), which are adjusted to control FWER. CIs in graphs are calculated directly from the data without adjustments to provide readers with an alternative perspective of the data.

Results for *H1* (Metacognitive CQ): The difference range in Metacognitive CQ is between –6 to 6, where positive values reflect an increase in self-rating after the task. Results (Figure 15) show in Condition 1 (N), Canadian participants increased their self-rating, compared with Condition 2 (G) and Condition 3 (G+R). The perception change in Condition 1 (N) was 2.68 ± [0.08, 5.26] higher than in Condition 2 (G) and Condition 3 (G+R), $t(54) = 2.65$, $p = .041$. In contrast, feedback in Condition 2 (G) and Condition 3 (G+R) reduced Canadians' self-ratings of Metacognitive CQ. In Figure 2 (right), the unadjusted CI of Canadians participants in Condition 2 (G) is slightly below zero, suggesting that providing feedback slightly lowered Canadians' self-perception of Metacognitive CQ.

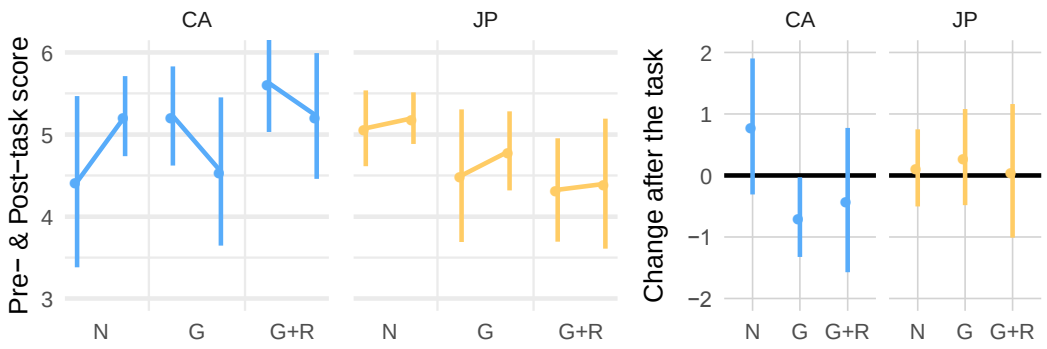


Figure 15. Metacognitive CQ score before and after task (left), and changes after the task (right). (Mean ± unadj. 95% CI)

While our quantitative results do not support *H1,* our qualitative findings indicate Canadians may have been overconfident in their self-rating of Metacognitive CQ (Condition 1), perceiving themselves to have higher Metacognitive CQ merely by going through the task. In contrast, feedback in Conditions 2 and 3 may have increased Canadians' Metacognitive CQ, but led them to perceive themselves as less culturally-aware than they originally believed. Canadians' decrease (rather than increase) in self-ratings may have also occurred due to the CQ Scale [Van Dyne et al., 2008] - this scale was originally developed for (typically) one-time

assessment of current skills, rather than for multiple assessments after short-term training interventions [Ang et al., 2007, Ng et al., 2012]. Our results do not indicate differences across conditions for Japanese participants. Based on our qualitative findings, we speculate this may be because Japanese participants were communicating in a non-native language and consequently, already conscious of potential cultural differences before beginning the task. Another speculation is that Canadians live in a multi-cultural environment and consequently perceive themselves as culturally competent. They expect things that happen during the experiment (i.e. graphs, feedback) to fall within their expectations. If something happens that is against their expectations, they feel surprised. In contrast, Japanese participants live in a (more) mono-cultural environment and may already expect differences before beginning the task – that is, they are not surprised by the differences revealed by the feedback. Finally, an alternative explanation may be self-report response distortions due to cultural background – studies show that people from collectivistic cultures (e.g. China, Japan, South Korea) demonstrate a modesty bias when responding to traits that they perceive as socially desirable [Kitayama et al., 1997; Heine & Renshaw, 2002]. It may be that Japanese students perceived Metacognitive CQ as a socially desirable trait and scored themselves as lower than they actually perceive.

Analysis method for *H2*: To investigate *H2,* we measure the "similarity" of detected behaviors with regards to whether Japanese and Canadian participants became more similar in Round 2 compared to Round 1, in terms of their language use in the five cultural dimension graphs. We used the LIWC 2015 Dictionary [Pennebaker et al., 2015] to analyze participant emails. LIWC outputs a score $s_c^{(i,j,k)}$, which represents the percentage of words in the LIWC category c, out of total number of words in the email. $s_c^{(i,j,k)}$ represents the i^{th} dyad, the j^{th} email turn, nationality k for LIWC category c. For example, if the second email from the Canadian partner in dyad 1 contains 5 'Emotional expressiveness' words (out of 100 total words), $s_{EmotionalExp}^{(1,2,CA)} = 5$. We calculated the score difference for the cultural dimension graphs in each dyad and grouped the differences in seven dimensions (D): emotional expressiveness, individual-focus, group-focus, relationship-focus, short-term focus, long-term focus, informality (cf. Table 2). The score difference for dimension D is

$$\Delta_D^{(i,j)} = \frac{|\sum_{c \in D}(s^{(i,j,\mathrm{JP})} - s^{(i,j,\mathrm{CA})})|}{||D||}$$

The possible value of Δ_D is between 0 to 100. While participants exchanged emails in four turns, we excluded the 4th turn from our analysis for two reasons. First, participants often reached agreement before the 4th turn, where content of the 4th email no longer reflect negotiation processes. Second, the majority of participants' emails in the 4th turn were under 100 words, where low word count decreases reliability of LIWC results [Pennebaker et al., 2015; Cheng et al., 2009] (Section 8.2.7 provides further details). Therefore, in the following result, we have 3 Conditions × 3 Email turns × 10 dyads = 90 data points. We conducted planned contrasts which compares each email to its previous one (2 – 1 and 3 – 2) for each dimension.

Results for *H2* (Similarity in language use): Results do not support *H2,* as we found no statistically significant contrasts across conditions, with one exception. For this exception, although the difference is statistically significant, the size of effect is small (1.26 on a scale of 0–100). Since our qualitative findings do not provide further support for this exception, we refer readers to Section 8.2.7 for further details of this analysis. Overall, our results do not support *H2*, where Condition 2 (G) and Condition 3 (G+R) did not lead culturally diverse members to become more similar in cultural dimension language use after receiving feedback. While our qualitative findings indicate participants did have intentions to adapt to one another in Round 2, possible reasons for the above result may be 1) behavior change may have occurred in Round 2, though because we did not inform participants how the graphs were calculated, the ways people changed may not have been detected by the LIWC categories we measured, or 2) despite intention to change, language use is largely unconscious and difficult to influence [Levelt, 1989].

Analysis method for *H3*: To investigate *H3,* we measure the notion of "receptivity" to different ideas or perspectives by comparing how much partners **yielded** to each other. A participant yielded to his/her partner if his/her *INITIAL* choices of social programs differ from the dyad's *FINAL* choices. This difference is determined by the Damerau–Levenshtein distance (*DLDist*): the number of insertions, substitutions, deletions and replacement between *INITIAL* and *FINAL*. In our study, the possible *DLDist* is 0 (*INITIAL* = *FINAL*), 1, or 2 (none of *INITIAL*

made it into *FINAL*). We excluded one group from Condition 2 (G) since each partner stated only one program choice in the first email, rather than two. We conducted confirmatory contrast analysis for each nationality, using the same analysis method as in *H1*.

Results for *H3* (yielding behaviors in the negotiation task): Results provide partial support for *H3*. Figure 16 shows the *DLDist* by conditions and nationality, in terms of proportion of the number of participants (left) and average score (right). Japanese participants yielded more to Canadian partners in Condition 1 (N) compared to Condition 2 (G) and Condition 3 (G+R). The contrast analysis shows *DLDist* difference of 1.61 ± [0.57, 2.65], $t(52) = 3.99$, $p < .001$, suggesting that feedback in Conditions 2 and 3 balanced yielding behaviors between Japanese and Canadian participants. We found no statistically significant differences between Condition 2 (G) and Condition 3 (G+R).

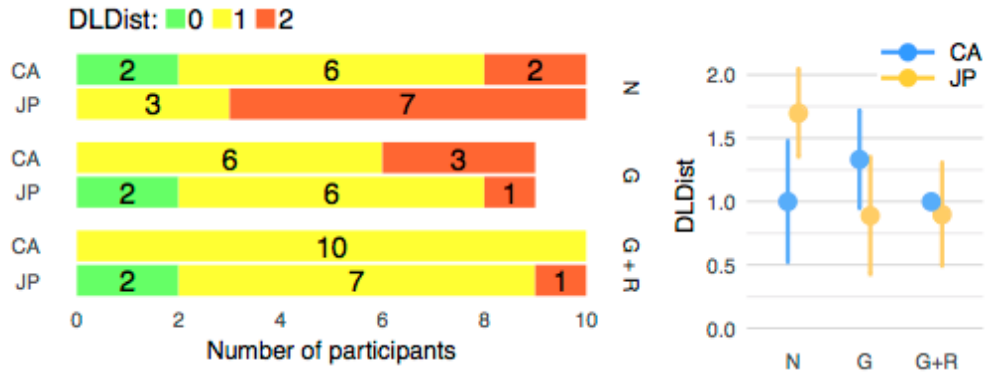


Figure 16. Participants' yielding behaviors in the negotiation task, in proportion (left) and mean ± unadjusted 95% CI (right).

8.2.4 Impact of Condition 2 Feedback on Intercultural Conflict

To explore Research Question #4 – the impact of Condition 2 (G) feedback on participants' perceptions of intercultural conflict, we organize our findings in two parts. First, we present how Canadians and Japanese participants valued different graphs. Second, we discuss the impact of the graphs on participants' intentions for behavioral changes in Round 2. Throughout this section, we present interview quotes from Condition 2, though the themes we observed were present in both Condition 2 and Condition 3.

8.2.4.1. Japanese and Canadian participants valued different graphs

Japanese participants highly valued the 'Level of Relationship-Focus' and 'Individual or Group-Focus' graph. All Japanese participants in Condition 2 and 3 interpreted the 'relationship-focus' graph to reflect how much one accommodated and yielded to their partner during the negotiation task. For many, their own score was comparatively lower than their partner's, contrary to their expectations. For example, C2-G17-JP*: "The score was lower than I expected. I was mindful not to make her feel uncomfortable. This isn't a competition, we're trying to reach an agreement. So I was careful not to say things which might destroy our relationship".*

C2-G14-JP*: "I was sad to see my relationship score was low. It was against my expectations. […] I always valued relationship building, but the graph showed that I didn't".*

Some Japanese participants placed high value on the 'Individual or Group-Focus' graph, linking a higher level of 'group-focus' to caring for the relationship by accommodating to their partner. For example: C2-G17-JP: *"I thought my 'group' score would be higher. I showed respect to her opinions and then expressed my thoughts below. It's not what I expected. I don't quite agree."*

In contrast, most Canadian participants did not place high importance on the 'relationship-focus' graph. Many believed that a strong relationship focus was not necessary to perform the task at hand, and may detract from the necessary formality needed to emulate the role of a financial advisor. For example: C2-G17-CA: "*Especially in working emails, […] it should be very formal and not relationship-based. I'm more goal-oriented than relationship-oriented, so this graph wasn't a focus for me".*

Canadian participants valued the 'Emotional Expressiveness', 'Level of Informality', and for some, the 'Individual or Group-Focus graph'. For the 'Emotional Expressiveness' graph, some perceived emotions as detracting from logical decision-making, whereas others interpreted "emotional expressiveness" to reflect engagement or investment in the social programs. For example, C2-G17-CA: "*I found it good we weren't being overly emotional about it, or that's the way I took it. […] Emotions can only go so far. When emotions cloud judgement, […] you might make rash decisions. […] It's a logistics task, so separating that out is pretty important".*

For the 'Level of Informality' graph, most participants felt that formality is required in business emails. However, many also believed that being less formal allows for establishment of rapport, which in turn, allows for effective task completion. For example, C2-G18-CA: "*'Informality' was really low for both of us. That's when I realized, wow, I'm really formal with my communication. Hers was low as well but mine was pretty much zero. So I thought I don't have to be totally rigid and formal in how I communicate, as long as I'm being concise and clear".*

Finally, many participants valued the 'Individual or Group-Focus' graph, where all participants perceived 'group-focus' as better than 'individual-focus'. For example, C2-G20-CA: *"Higher group-focus is better - that's how I want to be perceived – as someone who cares about others".*

In contrast, Japanese participants did not react strongly to 'Emotional Expressiveness' or 'Level of Informality' graph. For the latter graph, participants were mindful to match the formality of their Canadian partner.

8.2.4.2. Impact of the graphs on participants' intentions to change in Round 2

Although Canadian and Japanese participants valued different graphs, participants from both nationalities were motivated by the graphs to compromise and accommodate with their partner more in Round 2. We first present the specific impacts of graph feedback in Round 2, and then discuss the general impacts of graph feedback on the three areas of intercultural conflict.

Specific impacts of graph feedback: After seeing the graphs in Round 1, most participants were motivated in Round 2 to "improve" upon the graphs they most valued. Japanese participants aimed to increase their 'relationship-focus' and 'group-focus', by accommodating their partner's opinion, and by mimicking their partner to achieve similar communication styles. Participants perceived similar communication styles may improve their 'Group-Focus' score. For example, C2-G20-JP: *"In Round 1, I avoided using casual words even if my partner used them since I was afraid of misunderstandings. But in Round 2, I tried to copy my partner's wording - I felt using non-casual words isn't good for relationship-building. I thought mimicking his style would also improve my 'group-focus'".*

C2-G17-JP: *"In Round 1, my 'relationship-focus' was lower than I thought. So I paid more attention in Round 2 to show care to my partner's opinion".*

In Round 2, Canadian participants aimed to increase level of informality and group-focus, and match their partner's emotional expressiveness to show the same level of task engagement. Canadian participants often discussed these three graphs in connection with each other, hoping these changes would lead to better teamwork. For example, C2-G16-CA: *"I was trying to be less formal, not confrontational. […]I was reinforcing and validating what she was saying, like working as a team, as opposed to two people on opposite sides. I tried to increase emotional expressiveness to match hers".*

C2-G18-CA: *"I was afraid I had intimidated my partner. […] I felt it might be better to communicate in a less formal way, making it feel less like a government form and more like figuring out what to eat for dinner. [The graphs] made me think maybe I'm very unemotional and formal. It didn't need to be at that level".*

General impacts of graph feedback on areas of intercultural conflict: We discuss how the graph feedback supported Canadians in perspective-taking of their partner's program choices (mitigating Conflict #1), perceiving cultural communication style differences between them and their partner (mitigating Conflict #2), and motivating Canadians to yield and accommodate their partner more in Round 2 (mitigating Conflict #3). For Japanese participants, the graph feedback motivated specific graph changes to redeem one's score for 'relationship-focus' and 'group-focus' to match with internal cultural values. However, no findings emerged in Japanese interview data regarding general impacts of the graph feedback on mitigating perceptions of conflict.

For Canadian participants, the graph feedback acted as a visible externalization of invisible cultural differences, making differences in cultural communication styles more salient (mitigating participant perceptions of Conflict #2). For example, C2-G15-CA: *"We were speaking English and it didn't even cross my mind it was someone from a different culture. But seeing the graph and taking a step back, like right, he is from a different country and culture and it made sense that we differ on all these traits".*

C2-G17-CA: *"The graphs kind of opened my eyes, like a lightbulb, like, this is actually happening. Before it was like, this is cool, I'm talking to someone from a different culture. Like yes, there's going to be differences but the graphs illustrated for me where those differences lie. It definitely made me more critical and aware of my own writing".*

After seeing the graphs, Canadian participants felt a sense of commonality with their partner, realizing that both were working towards the same goal (mitigating perceptions of Conflict #1). In comparison to Round 1 where some aimed to persuade their partner of their own program choices, in Round 2, Canadian participants were motivated to accommodate and yield more to their partner's choices (mitigating perceptions of Conflict #3). For example, C2-G12-CA*: "In the first two emails, I felt 'Why couldn't he see things my way? My way is clearly the better way'. Once I saw the graphs, I started looking into Japanese culture a bit more, to get a better understanding of the 'overwork' issue. I wanted […] ask genuine questions about his arguments, so I could see their benefit in a different light".*

C2-G19-CA: "*In Round 1, I was more 'this is my opinion and I'm sticking to it' and she was more 'I'll listen to your side'. Without the graphs, […] we wouldn't have adjusted our opinions to the other person as fast as we did. I would have eventually adjusted but not in four emails. It would have taken me longer to pick up on her writing style".*

From the Japanese perspective, several participants perceived their partner became more accommodating in Round 2. This changed the impression they had of their partner from a person who is "inflexible" and "non-inclusive" to a person who is accommodating and cares about the relationship. For example, C2-G17-JP: *"I think my partner started to accept my opinions more [in Round 2]. Her standpoint basically didn't change, but I felt that she showed more respect to my opinions."*

C2-G16-JP: *"My partner suddenly changed his attitude in his third email and yielded to my choices. I was surprised because until then, I thought he's a strong-headed person who doesn't listen to others' opinions".*

8.2.5 Impact of Condition 3 Feedback on Intercultural Conflict

To explore Research Question #4 - the impact of Condition 3 (G+R) feedback on participant perceptions of intercultural conflict, we categorize our findings along two themes: 1) writing

the self-reflection and 2) reading their partner's self-reflection. We illustrate with interview quotes (which represent participants' intentions when writing the self-reflections, and interpretations when reading their partner's self-reflection), and when relevant, participants' written self-reflections. In Theme 2, we first discuss how the shared self-reflections both mitigated and exacerbated participant perceptions of intercultural conflict. In both themes, we discuss how shared self-reflections acted as a meta-channel to communication, impacting Japanese and Canadian participants in asymmetric ways.

8.2.5.1. Writing the shared self-reflection

Canadian participants primarily explained their own graph results when writing the self-reflection and at times, implicitly revealed their cultural values. For example, C3-G30-CA: *"My expressiveness was lower than my partner's because I think it would have made this task seem more personal than professional"*. Other times, Canadians offered an explanation for the graph in relation to the email content. For example, C3-G27-CA: *"I think I had the higher group-focus because I was thinking of a larger scale picture, of a country rather than a community."* Several Canadians indicated the self-reflections were difficult to write, since they did not know how the graphs were calculated.

In contrast, Japanese participants wrote the self-reflection with the intention to improve their partner's impression of them. As mentioned in "Areas of Intercultural Conflict", all participants felt limited in expressing themselves in a foreign language. Many believed their partners developed negative impressions of them as someone who is "*passive*" or "*not good at debating*", and hoped to improve this through the shared self-reflection. For example, C3-G28-JP: *"I felt I wasn't able to express my ideas properly. In my self-reflection, I tried to explain the graphs objectively. I hope it changed my partner's impression of me"*.

Other Japanese participants used the self-reflection to establish rapport with their partner through compliments and praise for their opinions. For example, C3-G29-JP wrote for 'Relationship-Focus': "*My partner is very intelligent and kind, so I tried to use more relationship-focus words, but because my English is poor, I couldn't use them well."* For 'Short-term or Long-term Focus', he wrote: "*At my first email, I focused on long-term goals, but my partner helps me noticing the importance of short-term focus. I was really impressed by her smart point of view."*

Despite their best efforts however, Japanese participants felt it was unlikely they could change their partner's impression of them, since they encountered the same language barriers when writing the self-reflection as in the negotiation task.

8.2.5.2. Reading my partner's self-reflection

Reading their partner's self-reflections mitigated participant perceptions of intercultural conflict, and provided Canadian and Japanese participants with asymmetric value.

Canadians: 6/10 Canadian participants in Condition 3 felt they gained insight into their Japanese partner from reading their self-reflection, which promoted a sense of commonality and empathy for their partner's perspective. For example, C3-G24-CA: *"My partner wrote he was going off of what he was seeing around him, just like I was. He wasn't understanding how drug rehabilitation programs are important, just like I wasn't understanding how being overworked is. After seeing the [feedback], I realized right away we're both on the same side of things. I was able to be more understanding and more curious".*

Other Canadians felt a "bond" through the shared activity of writing the self-reflection. For example, C3-G26-CA*: "Because he had to do the same thing I did, […] it just brought more of a partnership. It helped us relate and understand each other a lot better. […] I don't think you'd get that just by sending a few emails back and forth".*

Some Canadians gained a "different sense" of their partner after reading their self-reflection, feeling that it allowed for a different type of communication that was not appropriate in the emails. For example, C3-G29-CA: "He wrote: 'My partner used great formal business-like words and I really respect her'. It was really sweet. Because we never said any compliments to each other [in the emails], it put a different tone when I went back to the emails. The reflections were quite informal and you could write whatever. Whereas for the emails, you were trying to act as the financial advisor".

For Canadians, reading their partner's self-reflection established a sense of commonality and rapport with their partner, thus mitigating perceptions of Conflict #1 and indirectly, Conflict #3. However, 4/10 Canadian participants in Condition 3 said they did not learn anything from reading their partner's self-reflections. We discuss this in later sections.

Japanese: All 10 Japanese participants in Condition 3 felt reading their partner's self-reflection was valuable. Although Canadians did not intend to write their self-reflection with the goal to change their partner's impressions of them, Japanese impressions of their partner did change from an "*inflexible*" leader-type to an inclusive "*coordinator*" who cared about the relationship. For example, C3-G22-JP: *"[In Round 1], I had the impression they're individualistic people who don't put emphasis on personal relationships. But after reading her self-reflection, I learned that my partner values relationship building and group-thinking. I looked back on our emails and realized her writing was gentle. I felt we're more similar than I had expected. I was being too defensive".*

C3-G24-JP: *"I didn't know he was consciously choosing words that value relationships. […] I didn't think he cared about those things. He had a strong opinion and insisted on it. Insisting on one's own opinion means he's not thinking about our relationship. When I think about it now, I guess they're different things, but when I was exchanging emails with him, I felt he wasn't thinking about our relationship".*

For Japanese participants, reading their partner's self-reflection led to an improved impression of their Canadian partner, of someone "who cares about the relationship". This in turn, may have mitigated perceptions of Conflict #3.

8.2.5.3. When self-reflections exacerbated conflict

We now present two dyad-level examples of when self-reflections exacerbated Conflict #3. In both examples, the Japanese partner perceived conflict regarding 'care for the relationship', whereas the Canadian partner did not. Though Japanese partners wrote the value they placed on the 'relationship-focus' graph in their self-reflection, Canadian partners did not realize the significance it had for their partner, and reported gaining no new insights from reading their partner's self-reflection.

Example 1: In this dyad (C3-G27), the Japanese participant perceived her partner as "*direct*" and "*inflexible*", saying in her interview: "*I felt like he didn't care about my opinion. He finished his email by expressing his thoughts, rather than asking what I thought".* In her Round 1 self-reflection, she hoped to convey the value 'relationship-focus' had for her: "*I used more relationship-focus words than my partner because I tried to keep good relationship […] to make our discussions work well".* Despite

her efforts, the Canadian partner reported in his interview that there was "*nothing surprising"* in his partner's self-reflection, and did not perceive any conflict between him and his partner.

Example 2: In this dyad (C3-G21), the Japanese partner said during her interview she was "*shocked*" at seeing her low 'relationship-focus' graph in Round 1 and intended to improve this in Round 2. In contrast, the Canadian partner perceived they had a "*good relationship*", where neither partner "*was ever upset about the other's point of view"*. In her self-reflection in Round 1, the Japanese partner wrote: "*My level of relationship is much lower than my partner. Was my [e]mail that cold?"* In his self-reflection, the Canadian partner wrote: "*I believe my culture allows for greater use of relationship and informal terms. I believe it helps build a connection amongst team members."*

In her interview, the Japanese partner said she felt offended after reading her partner's self-reflection, saying: *"My partner explained he had a high relationship score because he values cooperativeness and the relationship. I felt like he's implicitly saying I'm not cooperative and didn't care about the relationship. I didn't get over-emotional but […] the process of making the final decision was not one-sided. We both accommodated"*. In contrast, the Canadian partner said during his interview: *"Reading her self-reflection made me feel like we're very similar – we both didn't realize we were going to score as high or as low as we did on certain areas. She wrote 'Are my emails too cold?' I guess I could have wrote 'Are my emails too relationship-focused? Am I weirding people out?' (Laughs) It was nice to know we were both in the same boat, which might have made it easier to finish our decision"*. Though both partners valued relationship-building, the Canadian partner's self-reflection unintentionally offended the Japanese partner.

8.2.6 Summary of Research Question #4 findings

Feedback impacted Canadians and Japanese differently. For Canadian participants, Condition 2 (G) feedback mitigated perceptions of Conflict #1 (by evoking a sense of commonality with their partner), Conflict #2 (by making cultural differences more salient), and Conflict #3 (by accommodating their partner more in Round 2). For Japanese participants, Condition 2 feedback did not mitigate perceptions of Conflict #1, 2, or 3.

Condition 3 feedback (G+R) impacted Japanese and Canadian participants in asymmetric ways. For Japanese participants, reading their partner's self-reflections improved the impression they had of their partner from an "inflexible" leader to an inclusive

"coordinator" who values relationships, potentially mitigating Conflict #3. For some Canadians, reading their partner's self-reflection evoked perspective-taking, mitigating Conflict #1 and indirectly Conflict #3. Other Canadians did not gain insight from reading their partner's self-reflection.

8.2.7 Detailed results for H2 (Similarity in language use)

This section provides further details to the analysis and results for Hypothesis 2 (H2) – similarity in language use – as discussed in the main submission.

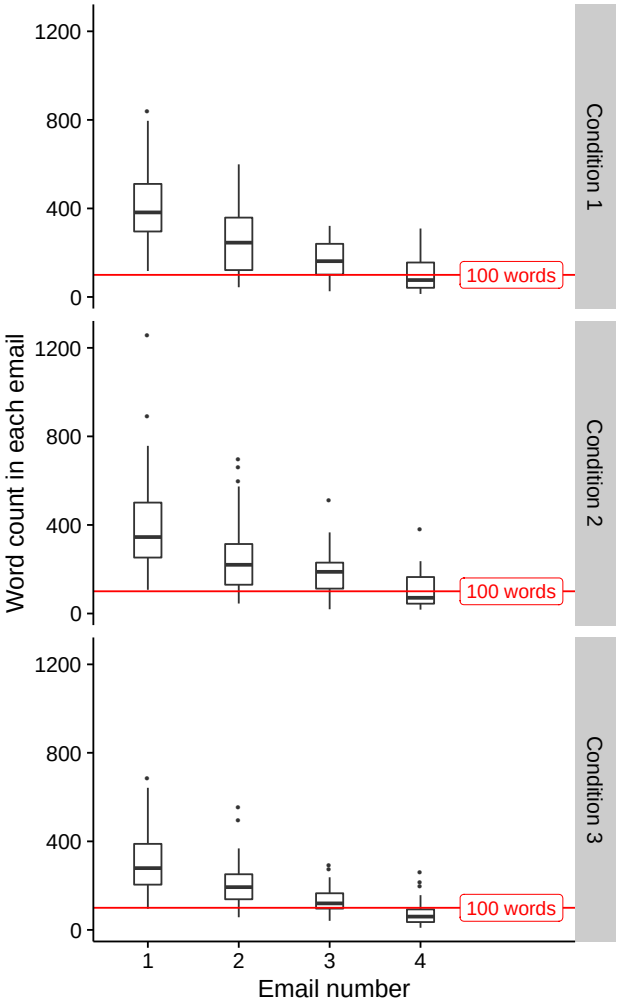


Figure 17. Word count in later emails are lower than earlier emails. We excluded email #4 from our analysis due to a low word count (under 100 words).

Excluding email #4: Figure 17 shows the word count in each email across experiment conditions, where email #4 is primarily under 100 words – a criterion we used for exclusion due to unreliable results from a low word count [Pennebaker et al., 2015; Cheng et al., 2009].

Detailed results for H2: To investigate the effect of experiment conditions on *H2* (similarity in language use), we used the LIWC 2015 Dictionary to analyze participant emails [Pennebaker et al., 2015]. The confidence intervals and *p*-values in the results below are adjusted within each measurement to control family-wise error rate $\alpha = .05$ within each dimension, by using single-step adjustment based on joint *t* distribution.

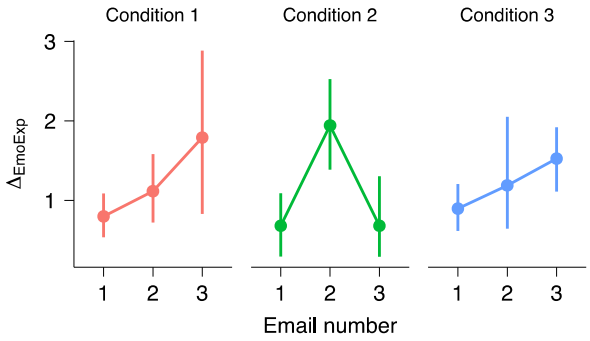


Figure 18. The emotional expressiveness of the dyads in Condition 2 (G) diverged in email #2 but converged in email #3. This trend is not found in other conditions.

As discussed in the main submission, our results do not support *H2,* as we found no statistically significant contrasts across conditions, with one exception. The only statistically significant contrast is for the 'emotional expressiveness' graph in Condition 2 (G), shown in Figure 18. The dyads' 'emotional expressiveness' started similarly in email #1, diverged in the email #2 ($t_{81} = 2.96$, $p = 0.023$), and then converged in the email #3 ($t_{81} = -2.96$, $p = 0.023$). Note that although the difference is statistically significant, the size of effect is small (only 1.26 out of 100, 95% CI [0.12, 2.40]). Our qualitative findings do not provide further support for this result so we cannot offer a meaningful speculation as to why this result occurred. For the reader's reference, Figure 19 presents results for the other cultural dimension graphs, none of which were statistically significant.

Exploratory analysis of other LIWC categories: In addition to the seven cultural dimensions, we also conducted exploratory analysis using the same Δ_D formula to analyze other LIWC categories not captured by the cultural dimensions including: Cognitive Processes, Tentative, Analytic, Tone, Clout, Risk, and Power categories. However, we found no meaningful or statistically significant differences across conditions nor across email numbers.

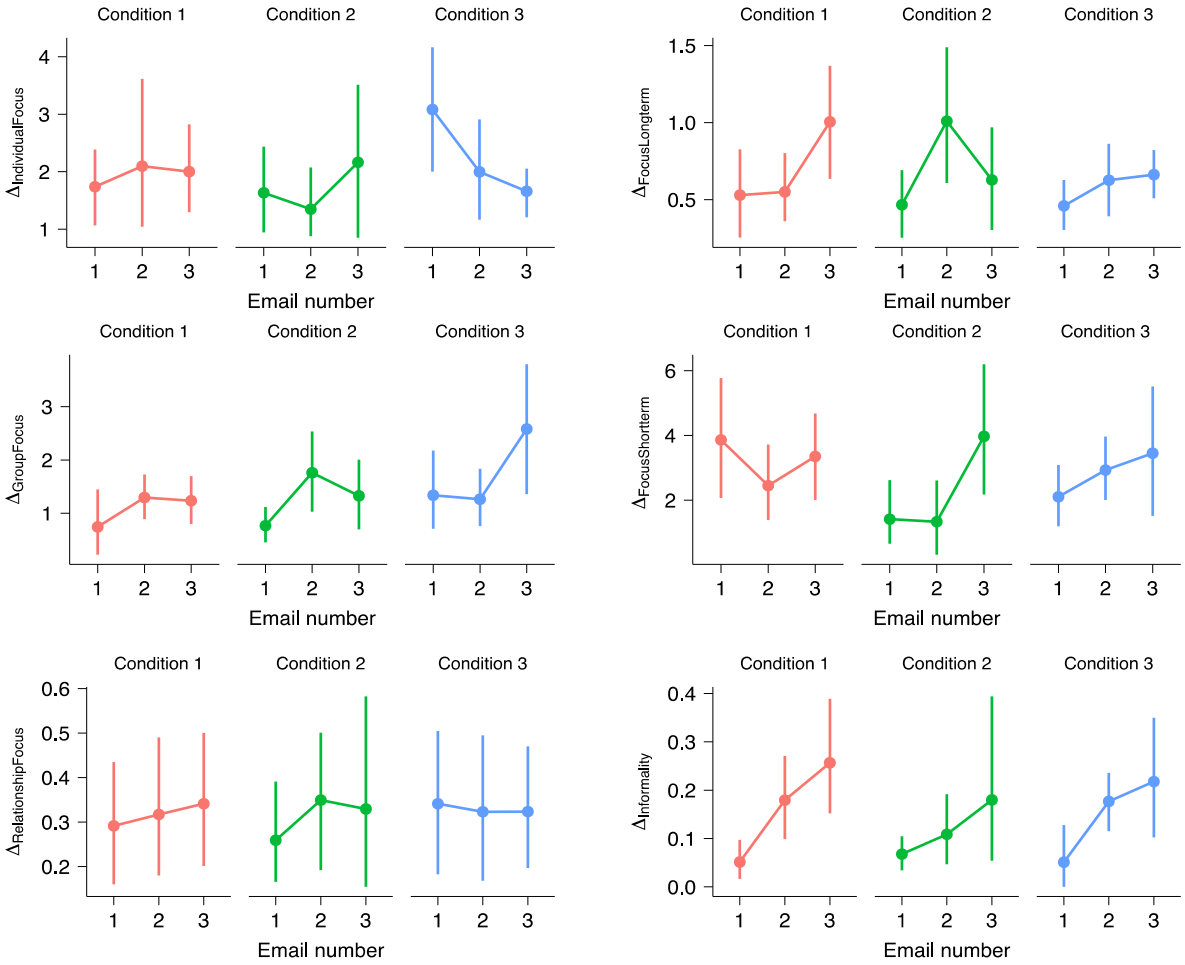


Figure 19. No statistically significant differences were found in LIWC analysis of other cultural dimensions

Exploratory analysis of Linguistic Style Matching (LSM): We also used the Linguistic Style Matching (LSM) score [Niederhoffer & Pennebaker, 2002] to assess whether dyads adjusted their linguistic style over the course of email communications. The LSM score accounts for *function words* (e.g., pronouns, prepositions, and articles) without regarding the content of the text. The resulting score is between 0 and 1.

Figure 20 shows the result of the LSM score across emails in three conditions. We found no meaningful or statistically significant differences across conditions nor across email numbers. One possible explanation for this result be that Japanese participants were already adapting to (mimicking) the writing style of their Canadian partner before receiving feedback. Another possible explanation for this absence of difference is that having only three email exchanges is too short for each partner to detect or adapt towards their partner's linguistic style. These are only speculations.

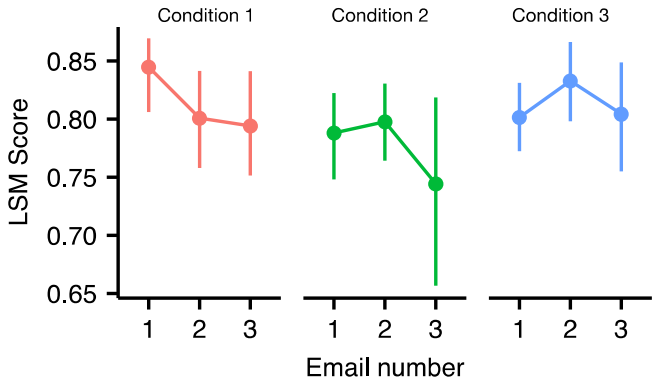


Figure 20. The linguistic style matching (LSM) score across emails and conditions. No statistically significant differences were found across conditions or across email numbers.

8.3 Opportunities for technology support

Based on our findings to *H1, H2, H3* and Research Question #4, we discuss opportunities for technology support. We present this in two categories: 1) Combining automatically-detected feedback with participants' interpretations of that feedback, and 2) meta-channels to support culturally diverse teams.

8.3.1 Combining automatically-detected feedback with participants' interpretations of that feedback

Our findings demonstrate potential in augmenting CMC tools with automatically-detected feedback of observable behaviors. However, contrary to previous feedback tools for homogeneous teams (e.g. [DiMicco & Bender, 2007, Tausczik & Pennebaker, 2013]), our findings show that in culturally diverse teams, the same (automatically-detected) feedback was interpreted in different ways depending on national culture of team members. National culture impacted how members perceived meaning from the graphs, what graphs they valued, and intentional behavioral changes in Round 2. We offer two arguments for why automatically-detected feedback should be accompanied by team members' subjective interpretations of that feedback:

First, subjective interpretations of feedback offers diverse members the opportunity to **explain and externalize deep-seated cultural values.** This is important since deep-level cultural differences evoke intercultural conflict [Hall, 1976], but are unconscious and not easily detectable. Improvements to this approach could be to ask members to share their *reactions* (rather than explanations) to the feedback – whether they were satisfied, whether it fit with their notion of their "ideal" self, and what (if anything) they wish to change and why. This could allow participants to focus reflection on the self, while avoiding unintentional conflicts through comparisons with their partner (as in C3-G21). Another improvement may be to ask members to rank the cultural dimension graphs in order of personal importance, and share reasoning for why they ranked that way. Such improvements reflect how participants naturally discussed and responded to the graphs during their semi-structured interviews.

Second, subjective interpretations of feedback can **evoke active reflection**, supporting members in learning intercultural competence (i.e. Metacognitive CQ) through increased awareness and consciousness of cultural differences. It is interesting to note that some participants struggled with writing the interpretations (self-reflections), indicating that they lacked an understanding of how the graphs were calculated, Yet, providing participants with calculation details may reduce their active reflection processes. As we saw in Conflict #2, mimicry of communication styles does not mean the absence of intercultural conflict. In fact,

mimicry may actually exacerbate the asymmetric nature of intercultural conflict – invisible to the person who did not adapt, but visible to the person who did adapt.

8.3.2 Meta-channels to support culturally diverse teams

Participants used the self-reflection as a meta-channel for communication, perceiving it offered a different tone and value compared to email interactions. (An example is when Japanese participants used the shared self-reflection to gain rapport with their partner through compliments and praise). Since GVTs comprise members of different cultural and language backgrounds, meta-channels should allow non-native speakers the opportunity to construct and manage impressions, ideally in their native language.

8.4 Limitations and future work

Our study is not without limitations. One limitation is that Canadian participants always initiated the negotiation and offered the first proposal. Since opening offers serve as anchors for following negotiations [Galinsky & Mussweiler, 2001], future work should randomize which partner initiates the negotiation. Another limitation is the rough measure we used for mapping LIWC categories to cultural dimensions. Though our findings demonstrate different interpretations of the cultural dimension graphs by Japanese and Canadian participants, future work should investigate a rigorous mapping of LIWC categories to cultural dimensions, as well as whether randomly assigned graph scores would also evoke reflection and different interpretations in culturally diverse teams. Third, our study investigated intercultural conflict between two national cultures – Japan and Canada – who interacted in English. Future work should explore cross-cultural pairs with different levels of cultural distance (e.g. Japan and China), interacting in a common language other than English. Finally, our study asked undergraduate university students with limited professional working experience to act in the role of "financial advisors", which may have impacted their communication style. Future work should replicate this study with professional GVT members.

8.5 Summary

This chapter addressed *H1, H2, H3* and Research Question #4. We presented the results of an experiment with 30 Japanese-Canadian dyads who completed a negotiation task over email. We explored three conditions: 1) no feedback, 2) automated language feedback (graphs of cultural dimensions), and 3) feedback in (2), with shared self-reflections. We identified three areas of intercultural conflict and discussed how feedback in Conditions 2 and 3 impacted participants' perceptions of intercultural conflict, their development of intercultural competence, their language use with relation to the automated feedback, and yielding behaviors within dyads. Our findings demonstrate potential in augmenting CMC tools with automatically-detected feedback combined with team members' subjective interpretations of that feedback to support culturally diverse, distributed teams. This chapter contributed to Research Objective V.

Chapter 9. Conclusion and future work

In this dissertation, we investigated the potential of feedback interventions to mitigate challenges arising from language diversity and cultural diversity in global virtual teams (GVTs). Towards this goal, we conducted a series of studies and experiments to explore the impact of feedback on attributions, intercultural competence, behaviors, perceptions of intercultural conflict and task outcomes. In this conclusion chapter, we review the progress towards our overarching thesis problem and research objectives described in Chapter 1. We discuss our contributions towards these objectives (and its accompanying research questions) and reflect on the feedback intervnetions used in this dissertation. Finally, we highlight directions for future work, and conclude with closing remarks.

9.1 Addressing thesis problem and research objectives

In this dissertation, we explored the potential of leveraging Computer-Mediated Communication (CMC) tools to alleviate challenges arising from language diversity and cultural diversity. The overarching thesis problem was:

Thesis problem:	How can Computer-Mediated Communication tools support GVT members in mitigating the challenges of 1) disparities in common language proficiency and 2) cultural diversity?

Towards this overarching thesis problem, we identified five high-level research objectives (proposed in Chapter 1) and accompanying research questions (proposed in later chapters).

9.1.1 Disparities in common language proficiency

To address the challenge of disparities in common language proficiency between native speakers (NS) and non-native speakers (NNS), Chapter 1 proposed Research Objective I and Research Objective II:

Objective I:	Expand our understanding of the attributions native speakers and non-native speakers form about each other in CMC.

Objective II:	Based on the above understanding, to investigate the potential of CMC tools to support such attribution processes.

Based on these research objectives, Chapter 3 proposed Research Question #1, while Chapter 4 proposed sub-questions a, b, c, d:

Research question #1:	What attributions do native speakers and non-native speakers form about each other in a multiparty videoconference with majority native speakers?
Sub-question #1a:	What attributions did NS/NNS make to understand their own graph data?
Sub-question #1b:	Did mismatches occur between how NS/NNS attributed their own graph data versus how others attributed their data?
Sub-question #1c:	What function (if any) did writing and sharing the self-reflection questionnaire about one's own graph data serve for NS and NNS?
Sub-question #1d:	What influence (if any) did reading other group members' self-reflection questionnaires have for NS and NNS?

To investigate Research Question #1 and sub-questions a, b, c, d, Chapter 4 presented an exploratory laboratory study with 16 groups (each group with 2 NS and 1 NNS) to investigate the attributions NS and NNS form about each other during videoconferencing. Each group completed a series of collaborative decision-making tasks. During each task, a 3D camera detected four measures of participants' verbal and non-verbal cues. After completing each collaborative task, participants were provided with feedback (i.e. a bar graph) comparing the detected behaviors of all group members (Figure 21). Following this, participants were asked to write a self-reflection questionnaire to explain their own graph data, which was shared with other group members. Feedback was intended as a probe to elicit NS and NNS attributions of one another during the collaborative tasks.

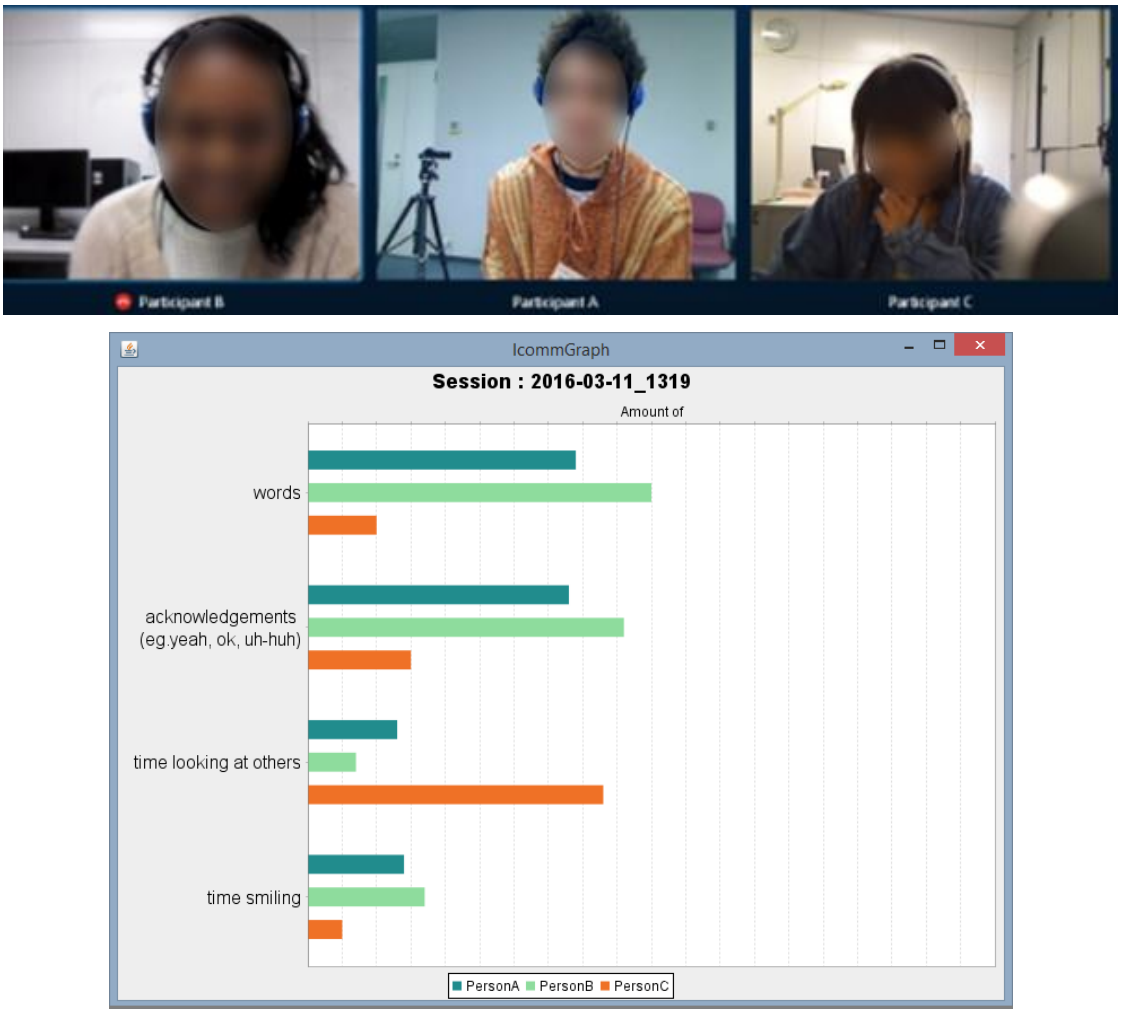


Figure 21. (Top): A screenshot of Experiment Group 7 - It includes three distributed team members (two native speakers and one non-native speaker), doing a collaboration task over 3-way videoconference. (Bottom): Example of automated quantitative feedback as shown to participants. Person A and Person B represent the native speakers, Person C represents the non-native speaker.

9.1.1.1. Summary of key findings

Findings from this study showed that the graph and shared self-reflection questionnaire acted as an effective probe to elicit attributions between NS and NNS.

1) Findings revealed **a significant mismatch between how NS attributed NNS' graph data** (compared with NNS' self-attributions), but no significant mismatch in how NNS attributed NS' graph data (compared with NS' self-attributions.

2) The **shared self-reflections acted as a "meta-channel" to communication**, allowing team members to resolve attribution mismatches, manage their self-presentation, and motivate more balanced team participation.

3) The combination of **automated quantitative feedback** (i.e. bar graphs) along with group members' **subjective interpretations** of that feedback (i.e. shared self-reflections) revealed that the same quantitative feedback was interpreted differently by native versus non-native speakers, impacting group members' attributions of one another. Unlike previous studies that found benefits of providing only automated quantitative feedback to homogeneous teams who speak the same native language (e.g. [DiMicco & Bender, 2007; Leshed et al., 2009]), our findings demonstrate that providing only quantitative feedback (without subjective interpretations of that feedback) can be detrimental in teams whose members differ in common language proficiency.

4) Finally, despite intentions to adapt behavior, we found no statistically significant differences in the average graph data for Trial 1 compared to Trial 2. Nonetheless, it is important to note that several NNS explicitly stated in their interviews that they were happy to be able to share their self-reflection questionnaires with NS members. In many cases, NNS participants said the quality of interaction felt better in Trial 2 and that NS members were more encouraging and mindful in providing NNS time to contribute.

9.1.2 Cultural diversity

The next part of this dissertation transitioned to address another challenge in global virtual teams – cultural diversity of its team members. We presented this research in two parts.

9.1.2.1. Gaining an understanding

In Part 1, we aimed to gain a deeper understanding of the intercultural communication challenges GVTs face in CMC. Specifically, Chapter 1 proposed Research Objective III and Research Objective IV:

Objective III:	Expand our understanding of the intercultural communication challenges culturally diverse professionals experience in face-to-face and CMC media.

Objective IV:	Expand our understanding of the adaptations culturally diverse professionals make in face-to-face and CMC media, to mitigate intercultural communication challenges.

Towards these research objectives, Chapter 5 proposed Research Questions #2 and #3:

Research question #2:	What kinds of communication challenges do culturally diverse professionals experience in face-to-face and CMC? Specifically, what challenges (if any) are unique to face-to-face? What challenges (if any) are unique to specific types of CMC? What challenges (if any) are common across face-to-face and CMC media?
Research question #3:	Assuming intercultural communication challenges exist, what adaptations (if any) do professionals make to mitigate such challenges in face-to-face and CMC media?

To investigate Research Questions #2 and #3, Chapter 6 presented a formative, qualitative study with 28 professionals from diverse national cultures to explore the intercultural communication challenges they experienced in face-to-face and CMC workplace interactions.

Summary of key findings

In Chapter 6, we identified four intercultural communication tensions that emerged most frequently in our dataset, including accepted range of emotional expression, level of formality, "fixed" versus flexible appointments and task versus social-orientation. We discussed how these tensions manifested in different media, and the successful and unsuccessful adaptations professionals made in different media to mitigate such challenges.

This findings from this study addressed Research Question #2 – we found that the most frequently occurring intercultural communication tensions were common to both face-to-face and CMC, regardless of the medium used. While our analysis suggested that intercultural communication tensions unique to face-to-face interactions and unique to CMC do exist, such tensions were not strongly represented in the data and therefore inconclusive.

These findings suggest that culture will be a persistent variable influencing workplace intercultural communication, no matter the medium. Our findings confirmed, extended and contradicted previous work.

This findings from this study addressed Research Question #3 - we presented examples of mimicry adaptation – when participants successfully mimicked or copied the behaviors of culturally diverse coworkers to mitigate intercultural communication tensions. We drew upon these adaptations as inspiration for design. We also presented the barriers other participants encountered when adapting behavior, including: barriers to interpreting interpersonal feedback and barriers to adapting behavior. Overall, Chapter 6 contributed to a richer understanding of the communication challenges arising from national culture differences in face-to-face and CMC media.

9.1.2.2. Design and evaluation

While Part 1 aimed to gain a richer understanding of intercultural communication challenges in CMC, in Part 2, we transition to the design and evaluation of support tools to mitigate such challenges in GVTs. Chapter 1 proposed Research Objective V:

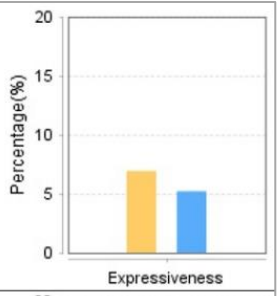
Objective V:	Explore the design and evaluation of CMC tools to support global virtual team members in developing intercultural competence – specifically, by probing reflection about intercultural encounters.

Towards this research objective, Chapter 8 built upon the feedback method used in Research Question #1 – that is, the combination of automated quantitative feedback of team members' behaviors, along with members' self-reflections of that feedback which was shared among group members. While Research Question #1 used this feedback as a probe to elicit attributions between native and non-native speakers, Chapter 8 explored the potential of feedback as an intervention to support culturally diverse GVT members in developing intercultural competence. In contrast to Research Question #1 which explored the combined effect of automated feedback with shared self-reflections, in Chapter 8, we investigated the impact of [no feedback] versus [automated feedback] versus [automated feedback with shared self-reflections]. We proposed three hypotheses and one exploratory research question:

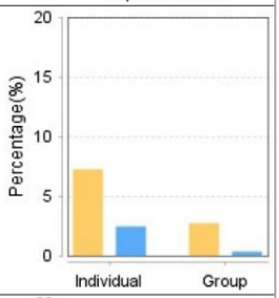
H1:	Compared to [no feedback], [automated feedback] will increase team members' **intercultural competence**. Assuming the previous is true, [shared self-reflections] with [automated feedback] will lead to higher intercultural competence, compared with only [automated feedback].
H2:	Compared to [no feedback], [automated feedback] will lead culturally diverse team members to become **more similar** with regards to **detected behaviors** in the automated feedback. Assuming the previous is true, adding [shared self-reflections] to [automated feedback] will lead members to become more similar, compared with only [automated feedback].
H3:	Compared to [no feedback], [automated feedback] will lead members to be **more receptive** to different ideas or perspectives offered by other members. Assuming the previous is true, adding [shared self-reflections] to [automated feedback] will increase receptivity, compared with only [automated feedback].
Research Question #4:	How does [no feedback] versus [automated feedback] versus [automated feedback with shared self-reflections] influence participants' **perceptions of intercultural conflict**?

To investigate *H1, H2, H3* and Research Question #4, Chapter 8 presented a mixed-methods experiment with 30 Japanese-Canadian dyads who completed a negotiation task over email. Using a between-subjects design, participants were randomized into one of three conditions: Condition 1 - No feedback (N); Condition 2 - automated language feedback in the form of Graphs (G); and Condition 3 - automated language feedback in the form of Graphs and shared self-Reflections (G+R). Figure 22 presents the graph feedback presented to participants in Conditions 2 and 3.

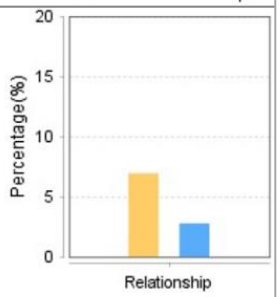
Emotional Expressiveness: Emotional expressiveness can vary greatly between cultures. Some cultures do not tend to express significant positive or negative emotions, where being able to control the display of one's emotions is highly valued. Other cultures tend to freely express both positive and negative emotions, where consistency between what one feels and what one displays is valued.



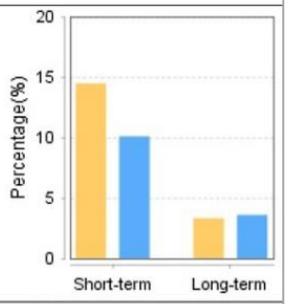
Individual or Group Focus: Cultures differ with regards to whether the interest of the group is more important than the interest of the individual. In individual-focus cultures, people are expected to take care of only themselves and their immediate families. In contrast, in group-focus cultures, people expect their relatives or members of a particular in-group (e.g. extended families, companies) to look after them.



Level of Relationship Focus: Cultures differ in terms of working styles. Relationship-focused cultures prefer to develop close-knit relationships between team members, believing that close relationships are essential for successful teamwork. In contrast, task-focused cultures prefer to focus on the task and get to know team members socially through task-related interactions. Such cultures do not necessarily believe close relationships are mandatory to achieve the task effectively.



Short-term or Long-term Focus: All cultures have to maintain some links with its own past while dealing with the challenges of the present and the future. Cultures prioritize these two goals differently. Short-term focus cultures tend to value the importance of profits of the current year. In contrast, long-term focus cultures tend to value the importance of profits 10 years from now.



Level of Informality: Cultures differ in how formal or informal communication is. Hierarchical cultures may use more formality, depending on the relationship between two people. Egalitarian cultures may use less formality (in other words - be more informal), regardless of the relationship between two people.

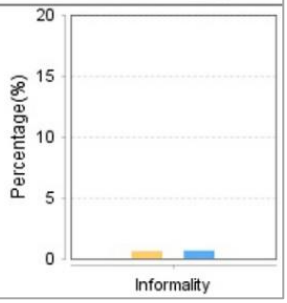


Figure 22. Example of automated language feedback (graphs of cultural dimensions) from Condition 3. Orange represents the Japanese partner. Blue represents the Canadian partner.

Summary of key findings

To answer Research Question #4, results show Japanese and Canadian partners interpreted the negotiation task differently, resulting in perceptions of intercultural conflict and negative impressions of their partner. Compared to Condition 1 (no feedback), automated language feedback (Condition 2) and shared self-reflections (Condition 3) made cultural differences more salient, motivating participants to empathize with their partner. Shared self-reflections (Condition 3) served as a meta-channel to communication, providing insight into each partner's intentions and cultural values.

To answer *H1,* qualitative interview results indicate that Canadians gained intercultural competence in Conditions 2 and 3, though contrary to our hypothesis, Canadian's self-ranking of intercultural competence was higher in Condition 1 after the task, and lower in Conditions 2 and 3 after the task. Our qualitative findings indicate Canadians in Condition 1 may have been overconfident in their self-rating, perceiving themselves to have higher intercultural competence merely by going through the task. In contrast, feedback in Conditions 2 and 3 may have led Canadians to perceive themselves as less culturally-aware than they originally believed. To answer *H2,* despite intentions to change behavior (as reflected in the qualitative interviews), quantitative results show that feedback did not impact language usage with regards to the culture dimension graphs, for any of the experiment conditions. To answer *H3*, Japanese participants yielded more to Canadians during the negotiation task in Condition 1 (no feedback), feedback in Conditions 2 and 3 balanced yielding behaviors between Japanese and Canadians. Our results do not indicate differences across conditions for Japanese participants.

9.2 Contributions

In this dissertation, we explored the potential of augmenting Computer-Mediated Communications tools with feedback interventions to mitigate challenges arising from language and cultural diversity in GVTs. Below, we outline our contributions:

1. A richer understanding of the attributions native and non-native speakers form about each other in CMC (Research Objective I). Findings from a mixed-method experiment revealed a significant mismatch between how NS attributed NNS' behaviors (compared with NNS' self-

attributions), but no significant mismatch in how NNS attributed NS' behaviors (compared with NS' self-attributions).

2. An exploration of a design approach for the augmentation of CMC tools to mitigate attribution mismatches (Research Objective II). Specifically we explored the use of feedback interventions – automated quantitative feedback of group members' behaviors, combined with members' subjective interpretations of that feedback, which was shared among the team. Feedback acted as a probe to elicit the attributions NS and NNS formed about each other, where the same automated feedback revealed different interpretations by NS versus NNS. The shared subjective interpretations acted as a meta-channel for communication and impression management, allowing team members to resolve attribution mismatches. In contrast to previous studies that found benefits of providing only automated quantitative feedback to homogeneous teams who speak the same native language (e.g. [DiMicco et al., 2004; Leshed et al., 2010]), our findings demonstrate that providing only automated quantitative feedback (without subjective interpretations of that feedback) can be detrimental in teams whose members differ in common language proficiency.

3. A richer understanding of the complex intercultural communication challenges GVT members experience in face-to-face and CMC workplace interactions, the impact of various media on such challenges, the behavioral adaptations some members made to mitigate such challenges as well as the barriers to adaptation other participants encountered (Research Objectives III and IV). Findings showed that the most frequently occurring intercultural communication challenges were common to face-to-face and CMC media, regardless of the medium used. While intercultural communication challenges unique to face-to-face and unique to CMC did exist, such challenges were not strongly represented in the dataset and therefore inconclusive. Our findings indicate that culture will be a persistent variable influencing communication, regardless of the medium.

4. The identification of a new avenue for design (Research Objective V). In contrast to previous technological approaches to developing intercultural competence (i.e. virtual avatars in simulated games), we identified the opportunity to utilize the communication channels GVT members already use (i.e. CMC) to support team members in developing intercultural

competence, as they go about their daily workplace interactions. In contrast to previous prescriptive approaches that focus on culture-specific training, I build upon the feedback method used in Research Objective #2 as a culture-general approach to prompt team members in reflection (a core component of intercultural competence) of their intercultural encounters.

5. The deployment of two technology prototypes in laboratory settings to gain an understanding of how feedback impacts attributions between NS and NNS (Research Objective II), and how feedback impacts team members' development of intercultural competence (Research Objective V). Experimental findings indicate promising outcomes of augmenting CMC tools with this feedback method to address the challenges of language and cultural diversity in GVTs.

9.3 Reflections on feedback interventions

In this dissertation, we explored the augmentation of CMC tools with feedback interventions to mitigate challenges arising from language and cultural diversity in GVTs. We briefly reflect on the design decisions made in this dissertation regarding feedback and evaluate lessons learned.

First, we explored a feedback intervention which combined the use of automated feedback with group members' subjective interpretations of that feedback. We believe this approach was successful in leveraging the strengths of human capabilities (i.e. interpreting complex, nuanced situations) and the strengths of computer capabilities (i.e. automatic sensing and detection of observable human behaviors). In real-life interactions with members who do not share the same native language or cultural background, there are no consistent or generalizable guidelines as to "correct" versus "incorrect" behaviors. Team members from diverse language and cultural backgrounds may have significantly different interpretations of the same situation. Given this complexity, we believe relying only on fully automated solutions may not be a practical or viable solution – as found in Chapters 4 and 8, shared self-reflections of automated feedback revealed different interpretations and offered different value to diverse team members.

Second, we provided retrospective rather than real-time feedback. Retrospective feedback allowed all team members to reflect on exactly the same feedback, after the interaction. Subsequently, this prompted conscious reflection by team members when filling out the subjective interpretations (i.e. shared self-reflections). This approach contrasts to other feedback systems that employ real-time feedback during synchronous face-to-face conversations (e.g. [DiMicco et al., 2006]) or Instant Messaging conversations (e.g. [Leshed et al., 2010]). Such approaches employ real-time feedback during on-going conversations, and are often designed to target the periphery of interlocutors' attention where primary attention focuses on the conversation at hand. In some cases, the goal of such peripheral feedback is to explore its impact of behavior in subconscious ways (e.g. [Balaam et al., 2011]). Yet, non-native speakers in GVTs who are already cognitively burdened with foreign language demands (Chapter 4) and may not be able to process or react to real-time feedback during on-going conversations.

Finally, since language and culture are inextricably intertwined [Yuan et al., 2013], GVT members who collaborate across diverse geographical regions will often experience language and culture challenges at the same time, rather isolated obstacles of only language or only culture. Therefore, we were particularly interested in a generalizable method which can potentially address both of these challenges at the same time. Based on our findings, the feedback approach used in this dissertation seemed flexible enough to address the challenges of language and cultural diversity. In both cases, subjective interpretations of feedback offered a crucial value to team members with diverse backgrounds, including impression management, establishing relationships or rapport as well as resolving perceptions of intercultural conflict.

9.4 Directions for future work

The findings in this dissertation point to exciting directions for future research. While Chapters 4, 6 and 8 discussed opportunities for future work specific to the presented study in that chapter, in this section, we synthesize across findings in this dissertation to highlight overarching directions that may be promising to explore. These include: variations in study setup, variations in feedback, feedback and impression management, and evaluation measures.

9.4.1 Variations in study setup

Group size: While this dissertation focused on small group interactions of two or three people, future work could explore the impact of feedback interventions in larger groups. In organizational settings, the average group size tends to be between two to seven members [Forsyth, 2014]. Investigating groups of this size may reveal more complex social dynamics compared to dyads and triads. Automated feedback may expose comparative categories within a group, such as members who within an "average" range, members who are "highest", or members who are "lowest". In this context, comparing one's own data with the data of other group members may lead to different interpretations and outcomes, compared to comparisons in a dyad or triad.

Real-world GVTs: This dissertation explored small distributed teams in experimental settings, where a task was explicitly defined, a specific CMC media was chosen for interaction, all members had equal status and decision-making power regarding the task, and the national culture of members was clearly defined. Yet, real-world GVTs may experience more nuanced and complex challenges in the workplace, such as organizational hierarchies, time pressures, ill-defined tasks, employing a combination of CMC media for collaboration, or interacting with members of mixed cultural backgrounds and varying levels of common language fluency. Future work could explore how feedback interventions are received by real-world GVTs and if or how such interventions support or hinder interactions compared to experimental settings.

9.4.2 Variations in feedback

Choice of visualization: Chapters 4 and 8 presented feedback in the form of simple bar graphs – bars appeared side-by-side, making it conducive for comparing one's own data with group members' data. Participants from Chapters 4 and 8 focused on the relative value of their own bars compared to other group members, rather than the absolute value. Some perceived their own bar as "too low" or "too high", and aimed to "decrease the gap" between their own data and their group members' data. Future work could explore variations in the choice of visualization and its impact on culturally diverse group members' perceptions and behaviors. For example, would simple changes in visualization choice impact participants' interpretations, reflections and reactions to feedback? Would such interpretations differ depending on the

cultural background of the group member? For instance, instead of bar graphs that appeared side-by-side, group members' behaviors could be visualized as an aggregate stacked bar, emphasizing the combined group behavior rather than individual behaviors. This simple alteration in visualization choice may be interpreted differently when viewed by members from individualistic cultures (that value autonomy and independence) compared to members from collectivistic cultures (that value commitment to the in-group) [Nouri et al., 2015].

National culture trends: Chapter 8 presented participants with feedback of their language use in relation to the cultural dimensions, along with a brief explanation of each cultural dimension. In the explanation, we did not explicitly state where Japanese and Canadian culture fit along that cultural dimension, in order to evoke reflection. Future work could explore variations in this feedback by presenting details about national culture trends. For instance, future work could not only visualize each group members' data (e.g. John scored 16 on emotional expressiveness, while Xin scored 20), but also the average national trend of each group members' culture (John's national culture trend is 18, whereas Xin's national culture trend is 5). Based on this feedback, questions might explore whether participants' behaviors were consistent with the average trend of that culture, how participants view their own data, their partner's data, their concept of self, their own culture, or their partner's culture after receiving such feedback. Questions might also explore how such interpretations influenced behaviors or adaptations in later communications with the same team members.

Level of abstraction: This dissertation explored feedback interventions with different levels of abstraction. Chapter 4 investigated feedback with a low level of abstraction - raw measures based on participant behaviors detected from videoconference: amount of words, amount of verbal acknowledgements, amount of time looking at others, and amount of time smiling. In contrast, Chapter 8 investigated feedback with a higher level of abstraction - language use with regards to national culture dimensions. In comparison to the raw behavioral measures (as in Chapter 4), language use of cultural dimensions represent internal and often sub-conscious cultural values, resulting in a higher level of abstraction of feedback. Feedback of raw behavioral measures (i.e. low abstraction) offer an easy-to-understand link between behavior and its impact on the visualization – potentially making it easier for team members to not only

explain but also influence the feedback. In contrast, feedback of internal cultural values (i.e. high abstraction) may be more difficult to explain and impact the visualization, particularly if team members are not informed about how the feedback is calculated. While this ambiguity around calculations may generate confusion, our Chapter 8 findings indicate that it also seemed to encourage more reflection. Future work could explore in what ways feedback with various levels of abstraction impact reflection and team member experiences.

Accuracy of feedback: Another interesting direction to explore is the level of required accuracy in the automatically-detected feedback. Previous work comparing accurate versus distorted feedback of speaker contribution demonstrated that participants trust and accept distorted feedback as an accurate representation of the conversation [Bergstrom & Karahalios, 2009]. However, distorted feedback had a surprisingly minimal impact on group dynamics when compared to undistorted feedback, leading the authors to speculate that behavior change was motivated by other factors outside of feedback accuracy. This poses interesting questions for future exploration: How important is the accuracy of automatically-detected feedback in provoking reflection or behavior change in GVTs? Since it is easier to keep track of team member behaviors in small groups, what are the effects of distorted feedback in small distributed teams (e.g. two or three members), versus bigger distributed teams (e.g. six members)? What are the impacts of distorted feedback when teams interact over various types of media (e.g. email versus videoconference)? While Bergstrom & Karahalios (2009) explored one specific type of distortion – manipulating speaker contribution – how do other types of distortion (e.g. language use, amount of smiling) affect perceptions and collaboration in GVTs? What are the implications for distorted feedback on the design of such technologies?

9.4.3 Feedback and impression management

Impression changes: As found in Chapters 4 and 8, feedback had a significant impact on the impressions distributed team members form of one another. Given GVTs limited opportunity for face-to-face interactions and heavy reliance on CMC tools [Cramton & Webber, 2005], the design of feedback interventions can strongly influence the impressions and attributions remote members form of one another. Automated feedback of members' behaviors offer one perspective of team behaviors, potentially making salient aspects of

behavior that may otherwise go unnoticed or require additional time to be perceived [Leshed et al., 2010]. Shared self-reflections offer another perspective, allowing team members to construct the impression they want others to form of them, and potentially correcting any attribution mismatches or inaccurate impressions (Chapters 4 and 8). An interesting direction for future work is to explore the impact of feedback interventions at different stages of team formation, and how that affects impressions and attributions. For example, a study by Tidwell and Walther (2002) found that distributed team members develop less detailed impressions over CMC but that these impressions are more resistant to change [Tidwell & Walther, 2002]. Questions might explore how feedback affects impressions or attributions at different stages of team formation (e.g. when a team first forms, versus a well-established team), and whether certain impressions are more or less resistant to change after receiving feedback.

Impressions of self: As found in Chapters 4 and 8, feedback not only elicited team members' impressions of one another, but also the impressions they had of themselves. Participants compared the feedback they saw with the expectations they had of themselves, to gauge whether they did "well" or not. Yet, culture affects how people respond to feedback. For example, Kurman et al. (2003) found that Japanese had stronger emotional reactions to negative feedback yet were more responsive to it compared to Americans, who tended to engage in compensatory self-enhancement [Heine et al., 2001]. Future work could explore the impact of feedback on participants' impressions of self, and whether reactions differ depending on the participants' cultural background. Thus far, this area of research is little explored.

9.4.4 Evaluation measures

Perception of the interaction versus actual behavior change: Participants in Chapters 4 and 8 developed an intention to change their behavior after receiving feedback. Yet, despite such intentions, results indicated no statistically significant differences in behavior before and after seeing the feedback. Chapters 4 and 8 proposed several possible explanations for why no actual behavior change occurred. Yet, our qualitative data told a different story - participants reported that after receiving feedback, they perceived other team members as more "collaborative" and more "inclusive" than before. This poses an interesting question – Is

actual behavior change a necessary outcome of feedback interventions? Or can participants' subjective perceptions of the interaction and of their team members act as a reliable measure of the quality of interaction? (e.g. Were my team members inclusive? Did we get along? Was there conflict?) Future work might also explore - when behavior change did occur (e.g. group members began to mimic each other and become more similar in language use), did this also lead team members' to have an improved subjective experience?

Observer ratings of intercultural competence: In Chapter 8, we hypothesized that feedback interventions would increase group members' intercultural competence, where we measured team members' self-reported intercultural competence (specifically, Metacognitive CQ) using the Cultural Intelligence Scale [van dyne]. On this scale, responses are recorded on a scale of 1 = "Strongly disagree" to 7 = "Strongly agree". Yet, studies show that self-report measures suffer from response distortions including response styles and response sets [Lanyon & Goodstein, 1997; Razavi, 2001]. Response style distortions imply bias in a particular direction regardless of the content of the test items. In contrast, response set distortions are generally related to content and reflect a conscious or unconscious attempt on the part of the respondent to create a certain impression. Studies show that response set distortions may be influenced by cultural background – individuals from collectivistic cultures (e.g. China, Japan, South Korea) demonstrate a modesty bias when responding to traits that they perceive as socially desirable [Kitayama et al., 1997; Heine & Renshaw, 2002]. In turn, they score themselves lower than they actually perceive. Given such distortions, questions arise as to what are other measures of intercultural competence? For example, one direction to explore may be to combine self-report with observer-ratings of intercultural competence – that is, team members could rate how culturally competent they perceive their team members to be. Such observer perceptions may be a more accurate reflection of how each interlocutor perceives the conversation or collaboration to be going. For example, for Metacognitive CQ, rather than asking from the first-person perspective ("I am conscious of the cultural knowledge I use when interacting with people with different cultural backgrounds" [vanDyne]), questions might ask from the observer perspective (e.g. "My partner is conscious of the cultural knowledge he uses when interacting with people with different cultural backgrounds").

9.5 Closing remarks

Organizations are, above all, human interaction systems [Daft et al., 1987]. Given the dramatic cultural transformation in today's workplace, improving communication between culturally diverse professionals with different common language proficiencies likely represents the single greatest opportunity for organizations to reach higher levels of success [Laroche, 2007]. As the prevalence of global virtual teams and Computer-Mediated Communication usage increases, the design of effective computer-mediated systems that can truly facilitate intercultural communication, perspective-taking and cross-lingual understanding offers a fruitful and challenging goal to work towards. It is our hope that the work in this dissertation offers a first step towards this complex space.

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Appendix A. Exploring attributions between native and non-native speakers in multiparty videoconference

This appendix presents materials used for the study on attributions between native and non-native speakers [Chapter 4].

a) Study recruitment – Native speakers of English

CALL FOR PARTICIPANTS! NATIVE AND NON-NATIVE ENGLISH SPEAKERS

WHO: We are looking for NAIST/University of Kyoto students. You must be a native English speaker (or) a non-native English speaker.

WHAT: We are conducting a study to explore group dynamics over videoconferencing (e.g. Google Hangout, Skype). The findings from this study will inform how to support group-work over videoconferencing. You will be asked to complete a task with two other people, speaking in English.

WHERE: The study will take place at NTT Communication Science Laboratories, Keihanna Science City, Kyoto.

WHEN: The study will last 2 hours. Interviews will be conducted on February 26, March 1, March 4, and March 7-9, between 10:00 and 17:00.

COMPENSATION: To thank you for your time, you will be compensated 10000 ¥ and bus/train transportation from your University to NTT.

HOW TO PARTICIPATE: Please fill out a 2-minute demographic questionnaire. You will be contacted by a researcher from NTT Communication Science Laboratories to confirm your participation.
If you are non-native English speaker, go to: https://www.surveymonkey.com/r/TQ99Q88
If you are a native English speaker, go to: https://www.surveymonkey.com/r/TWQJS6V

QUESTIONS OR CONCERNS? Please contact Dr. Naomi Yamashita at NTT Communication Science Research Lab at email: yamashita.naomi@lab.ntt.co.jp. If you have any questions or concerns regarding your rights as a participant in this study, you may contact the Institutional Review Board (IRB) for Human Participants in NTT at 046-240-5221 or email them at cs-rinri@lab.ntt.co.jp. If you have any questions regarding your personal information provided to this website and during the interview,

you may contact the NTT customer personal information desk at 03-3278-7722 (open from 10:00-12:00, 13:00-17:00, during business days).
PRIVACY AND CONFIDENTIALITY: *Please note that the interview will be video and audio-taped. The data will be strictly undisclosed and will be used exclusively for research. All your private information (e.g. name, audio, video data) will be strictly undisclosed and will not appear anywhere (including reports and presentations of this study). Your data will be anonymized and you will be identified only by a participant number (e.g. P12).*
RISKS AND DISCOMFORT: *There are no obvious physical, legal or economic risks associated with participating in this study. However, you will be asked questions about yourself and these questions may sometimes make you uncomfortable. You can refuse to answer any questions that you do not wish to answer during the interview, with no penalty, and no effect on the compensation earned before withdrawing.*
PARTICIPATION IS VOLUNTARY: *Your participation in this study is voluntary. Your participation has no effect on your relationship with any organization or service that may be involved in this research.*

b) Study recruitment – Non-native speakers of English

実験参加者募集のご案内
参加資格: TOEIC 500 **点以上の大学生**.
実験内容: **テレビ会議システムを介して，**2 **名の外国人とあなたの計** 3 **名で，英語で会話をして頂きます．会話の内容は，実験当日にお伝えしますが，日常会話レベルのものです**.
場所:NTT **コミュニケーション科学基礎研究所（けいはんな学研都市**)
http://www.kecl.ntt.co.jp/rps/access-keihanna.html
時間: **実験所要時間は** 2 **時間です．実施日は，**2 **月** 26 **日，**3 **月** 1 **日，**3 **月** 4 **日，**3 **月** 7 **日，** 8 **日，**9 **日の** 10:00 **から** 17:00 **です．参加頂ける時間帯を以下の** URL **から記入頂き，後日実** 験担当者と調整することによって，参加日時を決めさせて頂きます.
謝礼: 1 **万円＋交通費（大学から** NTT **研究所までの交通費とさせて頂きます）**
参加方法: **以下の** URL **にアクセスし，質問項目（英語）に回答してください．後日，実験** 担当者から連絡致します.
URL: https://www.surveymonkey.com/r/TQ99Q88

PARTICIPATION IS VOLUNTARY: Your participation in this study is voluntary. Your participation has no effect on your relationship with any organization or service that may be involved in this research.

RISKS AND DISCOMFORT: There are no obvious physical, legal or economic risks associated with participating in this study. However, you will be asked questions about yourself and these questions may sometimes make you uncomfortable. You can refuse to answer any questions that you do not wish to answer during the interview, with no penalty, and no effect on the compensation earned before withdrawing.

PRIVACY AND CONFIDENTIALITY: Please note that the interview will be video and audio-taped. The data will be strictly

undisclosed and will be used exclusively for research. All your private information (e.g. name, audio, video data) will be strictly undisclosed and will not appear anywhere (including reports and presentations of this study). Your data will be anonymized and you will be identified only by a participant number (e.g. P12).

QUESTIONS OR CONCERNS? Please contact Dr. Naomi Yamashita at NTT Communication Science Research Lab at email: yamashita.naomi@lab.ntt.co.jp. If you have any questions or concerns regarding your rights as a participant in this study, you may contact the Institutional Review Board (IRB) for Human Participants in NTT at 046-240-5221 or email them at cs-rinri@lab.ntt.co.jp.

If you have any questions regarding your personal information provided to this website during the interview, you may contact the NTT customer personal information desk at 03-3278-7722 (open from 10:00-12:00, 13:00-17:00, during business days).
問い合わせ先：NTT **コミュニケーション科学基礎研究所**
山下直美 (yamashita.naomi@lab.ntt.co.jp)

c) Consent form

Letter of Agreement Participant ID: _____

1. It is your freewill to join this experiment.
2. The experiment will last approximately 2 hours. Your participation will be compensated by NTT Communication Science Laboratories.
3. We will record audio and video data during the experiment. We may also take your photograph/video from behind in order to capture the computer screen and your voice.
4. All recorded data will be used exclusively for research purposes. Your private information (e.g. name, face, voice) will be strictly undisclosed.
5. We may refer to your data in written publications or oral presentations of this research. In all cases, your data will be anonymized. You will be identified only by a participant number (e.g. P12).
6. The findings from this experiment will inform the design of videoconferencing tools to support distributed group-work.

This experiment is conducted by:

Dr. Naomi Yamashita
NTT Communication Science Laboratories,
2-4 Hikaridai Seika-cho Soraku-gun
Kyoto 619-0237, Japan
Email: yamashita.naomi@lab.ntt.co.jp

Agreement
I understand and agree with the points stated above.

Date: _____
Name: _____
Signature: _____

d) Survival Tasks

Participants were asked to complete a series of collaborative decision-making tasks, adapted from the desert survival task series[22]. The survival tasks (ocean, lunar or desert) are often used in organizations to encourage team cohesion during initial team formation.

TRAINING TASK: DESERT SURVIVAL

You have crash-landed in a small airplane somewhere in the Arizona Desert. It is approximately 9:00 AM, in mid-August. The ground temperature will reach 54°C (130°F) degrees later today.

You and two other members are the only survivors. The airplane may explode at any minute, so you had to evacuate as soon as possible. Before evacuating, you were able to salvage 3 items from the crash. All items are in good condition. Now, you must rank the 3 items in order of importance to your survival.

The 3 items:

- .45 calibre pistol (loaded)
  A red and white parachute
- A cosmetic mirror

Step 1 (Your ranking): Rank the 3 items on your own. Write down your ranking in the table below. Note there is no right or wrong answer: there may be multiple ways to use each item and how you use each item is totally up to you. Feel free to write down your reasoning below. You have **5 minutes** for this task. No talking allowed.

Step 2 (Group ranking): Discuss with the other members and generate a group solution. It does not matter if the group solution is different from your own ranking (in step 1). However, you should try to persuade others so that the group solution becomes closer to your initial ranking. You have **5 minutes.**

Write your answers here:

Item	Your ranking (Step 1)	Group ranking (Step 2)
.45 calibre pistol (loaded)		
A red and white parachute		

[22] Human Synergistics Company. http://www.humansynergistics.com/

A cosmetic mirror		

TASK: LUNAR SURVIVAL

You are a member of a lunar exploration crew originally scheduled to meet with a mother ship on the lighted surface of the moon. Due to mechanical difficulties however, your ship was forced to land at a spot approximately 320 kilometers (200 miles) from the meeting point. During re-entry and landing, much of the equipment aboard was damaged, except for 5 items below. Since survival depends on reaching the mother ship, you and two other crewmembers must now rank the items needed for the 320 kilometer trip back to the mother ship.

The 5 items:

- FM receiver
- Oxygen
- Matches
- Milk
- Raft

Step 1 (Your ranking): Rank the 5 items on your own. Write down your ranking in the table below. Note there is no right or wrong answer: there may be multiple ways to use each item and how you use each item is totally up to you. Feel free to write down your reasoning below. You have 5 minutes for this task. No talking allowed.

Step 2 (Group ranking): Discuss with the other members and generate a group solution. It does not matter if the group solution is different from your own ranking (in step 1). However, you should try to persuade others so that the group solution becomes closer to your initial ranking. You have 15 minutes.

Write your answers here:

Item	Your ranking (Step 1)	Group ranking (Step 2)
FM receiver		
Oxygen		
Matches		
Milk		
Raft		

TASK: OCEAN SURVIVAL

You and two others are adrift on a private yacht in the Atlantic Ocean. As a consequence of a fire, much of the yacht and its contents have been destroyed. The yacht is now slowly sinking. Your location is not known because critical navigational equipment has been destroyed. Your best estimate is you are hundreds of miles away from the nearest land.

Below is a list of 5 items you saved, undamaged after the fire. In addition, you have a rubber life raft with oars, which is large enough to carry you, the other two members, and the items listed below. Now, you must rank the 5 items in order of importance to your survival.

The 5 items:

- Maps of the Atlantic Ocean
- 2 boxes of chocolate bars
- Nylon rope (15 feet)
- Cosmetic mirror
- Opaque plastic sheeting (20 square feet)

Step 1 (Your ranking): Rank the 5 items on your own. Write down your ranking in the table below. Note there is no right or wrong answer: there may be multiple ways to use each item and how you use each item is totally up to you. Feel free to write down your reasoning below. You have **5 minutes** for this task. No talking allowed.

Step 2 (Group ranking): Discuss with the other members and generate a group solution. It does not matter if the group solution is different from your own ranking (in step 1). However, you should try to persuade others so that the group solution becomes closer to your initial ranking. You have **15 minutes.**

Write your answers here:

Item	Your ranking (Step 1)	Group ranking (Step 2)
Maps of the Atlantic Ocean		
2 boxes of chocolate bars		
Nylon rope (15 feet)		
Cosmetic mirror		
Opaque plastic sheeting (20 square feet)		

e) Semi-structured interview questions

Interviews were semi-structured. The questions below provided a set of potential questions to ask, though not all questions were asked of all participants. Inquiries were open-ended, such that the most pressing issues for participants guided the conversation.

========== GRAPHS + COMPARE PEOPLE ==========

What were your **impressions** of the graphs?

Was there anything particularly **interesting or surprising** about the graphs?

- About **yourself**?
- About the **other two people**?
- When you **compare** yourself with Person 1? Compare with Person2?

What did each of the graphs mean to you? (What is your **interpretation**?)
Individually? (e.g. only the smiling graph)
Together? (e.g. all of the graphs together)

========== COMPARE TASKS + IMPACT OF FEEDBACK ==========

If you **compare Training Task and Task 1**, did you notice any differences in how you or others behaved? Please explain.

If you **compare Task 1 and Task 2**, did you notice any differences in how you or others behaved?

What influence did the feedback have, if any?
In terms of:

- own behavior
- interpretations of other people
- attitudes / impressions of other people
- interactions with other people
- did you adapt in some way? What? How?

Was the feedback was **useful** to you, when you did **Task 2**? Why or why not?

Was there **other feedback** you wished you had data about? (that wasn't shown?)

Appendix B. Understanding intercultural communication challenges in face-to-face and computer-mediated communication

This appendix presents materials used for the study on intercultural communication challenges in face-to-face and computer-mediated interactions [Chapter 6].

a) Study recruitment

Hello,

I am a researcher at the University of Zurich.

We are conducting a study to explore the communication challenges professionals experience when using internet communication tools (e.g. Email, Instant Messaging, Video chat), with people from culturally different backgrounds. The insights gained from this study will help to improve upon the design of internet communication technologies, with the goal to more effectively support communication among culturally diverse people.
Do you:

- work in an office environment in or near Zurich, Switzerland?
- use internet communication tools (e.g. Email, Instant Messaging, video chat) to communicate with professionals from culturally different backgrounds?
- can speak and understand intermediate level English (or higher)?

If so, we welcome you as a potential participant in our study!
Participants will be interviewed for 1 to 1.5 hours. To thank you for your time, you will be compensated 40 CHF. Do you match the above description? If so, fill out this 2-minute pre-interview questionnaire, and we will contact you if you are a suitable candidate for our study. http://www.surveymonkey.com/s/YHQ8MDC

b) Consent form

Informed Consent Form
A study to explore the social and cultural integration challenges foreigners experience in the workplace

Dear Sir or Madam:

The purpose of this study is to gain insight into the social and cultural integration challenges foreigners experience in the workplace, particularly with regards to communication. Our

understanding of these challenges will help to inform the design of supporting technologies that aim to help foreigners improve their non-verbal communication skills in the workplace.

What will I be asked to do?

If you choose to participate in this study, you will be interviewed for approximately 1 to 1.5 hours about communication or integration challenges you have experienced. We are interested in your stories, experiences, and any insights you wish to share.

What information will be collected?

You will be asked about your gender, cultural background, education, occupation, your migration experience, and relevant workplace experiences.

The interview will be audio-recorded and may be partially or fully transcribed. We will also take notes during your interview. With your permission, we may take photographs for our reference and analysis. With your permission, we may videorecord all or parts of the interview.

Are there risks to participating? There is no risk to participate in this study, beyond the risks associated with normal everyday activity. Participation in the study is voluntary and confidential. Your data will be anonymized. If it is ever shared with anyone outside of the research team, including any written publications or oral presentations based on this research, you will be identified only by a participant number (e.g. P12) or a pseudonym of your choosing.

You are free to withdraw your participation at any point during the study, without needing to provide any reasons. However, unless you request otherwise, any information you contribute up to the point at which you choose to withdraw will be retained and may be used in the study.

Are there benefits to participating? To thank you for your time, you will be compensated CHF 40. After the study, if you are interested in our research results or participating in any future studies on this topic, we will be happy to keep you informed.

What happens to the data?

All of your original data (notes, audio files, photos, videos) will be saved on password-protected devices or locked in university filing cabinets at the University of Zurich. They will be stored for a maximum period of 10 years.

Uses of the interview data

The data can be used and seen by researchers directly involved in this project. The results of this study may appear in both internal and external presentations and publications, as well as academic journals and conference proceedings. In all cases, your data will be anonymized.

Consent

By signing this form, you confirm the following statements:

- A researcher explained the study and the listed conditions to me.
- I had the opportunity to ask questions.

- I understood the answers and accept them.
- I am at least 18 years old.
- I had enough time to make the decision to participate.
- I agree to the participation.

In no way does signing this form waive your legal rights or release the investigators or involved institutions from their legal or professional responsibilities. You are free to withdraw from this research project at any time. Please feel free to ask for clarification or new information at any time during your participation.

Participant's name (please print)	Researcher's name (please print)
Location and date	Location and date
Participant's signature	Researcher's signature

Questions or Concerns?

A copy of this consent form has been given to you to keep. The researcher has kept a copy of the consent form. If you have further questions regarding our research, and/or your participation in this study, please contact:

Helen Ai He
Telephone +41 767858823
helen.he@ifi.uzh.ch

Prof. Dr. Elaine M. Huang, Ph.D.
Telephone +41 44 635 4411
huang@ifi.uzh.ch

c) Semi-structured interview questions – Face-to-face interactions

---- BACKGROUND AND CONTEXT ------

Can you tell me the story of how you came to [Switzerland]?

When did you move here?

How long have you lived here for?

Motivations to move?

How did you feel about moving to Switzerland? (e.g. excited? anxious?)

Did you know much about [Switzerland / countries you lived] before you moved here, if anything?

Did you expect any differences between Switzerland and _____, in terms of how people behaved?

--------INTEGRATION----------

What does integration mean to you?

How much does NVC matter?

How much do you think your personality helps in integration?

-------- MIGRATION PREPARATION ---------

Before you came here, what did you do (if anything) to prepare yourself for living in Switzerland?

After you came here, did you receive any support or help (e.g. from friends, family or government), when transitioning to live in Switzerland?

Were you able to make use of this help? (Was it helpful?, was advice accurate?)

After you came to Switzerland, what did you do (if anything) to try to adapt or fit into Swiss culture?

------ EXPERIENCES SO FAR -----

When you compare living in ___ versus in Switzerland, did you notice anything unusual or surprising in how people communicate or behave?

Now that you've lived here for XXXX time, what are your three *favorite* things about living in Switzerland?

What are your three *least favorite* things about living in Switzerland? (so, three things you don't like)

Do you feel like there has been any particularly difficult about integrating into the Swiss culture, if anything?

Do you feel accepted here? Why or why not?

-------- GENERAL WORKPLACE ----------

Now, I'd like to hear more about your workplace.

Can you tell me a bit about your current (office) job?

Do you work in a team?

- How many people?
- Is there any dependency on each other to get things done?

What is the office environment like?

- do they share an office?

What is the official language used at your workplace?

How would you describe your level of comfortable-bility in using [this language] In the office?
What are the nationalities of the other people you work with?
- international environment?

Have you worked in any other office jobs in Switzerland? Tell me about them.

What are your 3 favorite things about working here?

What are your *3 least* favorite things about working here?

-------- WORKPLACE INTERACTIONS ----------
Have you worked in an office in [home country]?

When you compare working in an office in your [home country] versus working in an office in Switzerland, do you notice any differences in how your coworkers people communicate or behave?

- *How do they interpret?*
- *What is their opinion?*
- *What is the appropriate behavior in home country?*

When you compare working in an office in your [home country] versus working in an office in Switzerland, do you notice any differences in how your boss communicates or behaves with you?

- *How do they interpret?*
- *What is their opinion?*
- *What is the appropriate behavior in home country?*

In your current job:
Last ___(the most recent workday)___, can you describe some of the interactions you had with other people in the office?
- *email?*
- *phone?*
- *Face to face?*

Would you say this is typical day-to-day / or week-to-week in terms of the people you usually interact with in a workday?

------- COMMUNICATION CHALLENGES ----------
Communication can sometimes be a challenging aspect in a work environment. I can imagine that these challenges might be especially difficult when coming into a new culture. Are there any aspects of communication in your current/previous job that you find particularly challenging?

- About what?
- With who?
- In which workplace contexts? (e.g. coffee break, team meeting)

Has there ever been a time when a miscommunication or confusion occurred with your *coworkers*? (e.g. in a team meeting, during coffee breaks, presentations, etc.?)

- how did they interpret coworkers?
- How did they feel about it?
- What do you think is the appropriate behaviour?

What do you think were the impacts of this miscommunication, if any?

Has there ever been a time when a miscommunication or confusion occurred with your *boss / superior*?

- how did they interpret coworkers?
- How did they feel about it?
- What do you think is the appropriate behaviour?

What do you think were the impacts of this miscommunication, if any?

- e.g. salary, performance reviews, etc.

-------- WORKPLACE RELATIONSHIPS ----------
Are you satisfied with the relationship you have with your coworkers? If not, what do you think could be better?

Are you satisfied with the relationship you have with your boss? If not, what do you think could be better?

In general, how do you feel about working here? Do feel accepted here? Why or why not?

-------- INFORMAL WORKPLACE RULES ----------
I'd like to ask you about the informal rules here in Switzerland….
For example, on the train, its kind of informal rule that if there many empty seats, you don't pick a seat immediately next to someone.

Do you feel like there any informal rules like this that exist in your workplace?
When did you first become aware of these rules?
How did you learn these rules?

-------- EMPLOYMENT INTERVIEW ----------
Can you tell me about the most recent interviewing experience you had.

How long ago was that?

When you compare an interview in your home country to an interview here in [Switzerland], what do you think are the differences?

- *process of job searching / interviewing*
- *cultural norms*
- *non-verbal*

In your interviewing experiences in Switzerland, what kinds of successes or challenges have you met?

What kinds of training / preparation did you do to get ready for the interview?
What was trained? What was natural?

Have the outcomes matched your expectations?

a) *Successful interview*
b) *Thought they did well, but did not get the job*
c) *Poor interview*

What gave you impression that you did well / poorly?

What would be your ideal job? Why?

What do you feel like is preventing you from getting it?

-------- PERFORMANCE REVIEW ----------
In your home country, did you ever get feedback from your boss/superior on how you were doing? What was that like?

Did you find it helpful?

Have you had any performance / feedback evaluations here in Switzerland?

When you compare a performance evaluation in your home country versus a performance evaluation in [Switzerland], what do you think are the differences?

What kinds of successes or challenges have you met?

-------- FINAL REFLECTION QUESTIONS ----------
How do you feel you've changed?

Is there anything you've learned about <u>how to behave in the workplace,</u> that you wish you known when you first came?

Do you plan on staying in Switzerland in the future? Why or why not?

If you could only choose one place to live (of the countries you've lived in), which country would you choose? Why?

Have you gone back to [home country]?
- When?
- How did you feel when going back?

What do you miss about your home country, if anything?

What would you miss from here (Switzerland)?

Has it been hard for you to keep your [home country] identity and integrate into a new culture?

Any other stories you wish to share?

d) Semi-structured interview questions – CMC interactions

BACKGROUND

I see that you were born in _____. How long did you live there for?
When did you move to Zurich? How long have you lived in Zurich for?
Did you work in any other countries before you came to Zurich? For how long?

GENERAL CMC

Tell me a bit about your current job. What do you do there?

If you think back to [most recent workday], starting with when you first arrived in the office, who did you communicate with and how did you communicate with them? (e.g. whether it was FTF or over email or phone, etc)

And in these interactions, is there anything you particularly liked about chatting FTF or using [computer tool]?

Is there anything you particularly disliked?

And in these interactions, how did you decide which communication medium to use? (e.g. FTF vs. computer tools?)

What do you think are the advantages (if any) when communicating with someone using [computer tool] compared to FTF?

What do you think are the challenges (if any) when communicating with someone using [computer tool], compared to FTF?

INTERCULTURAL CMC

In your preinterview questionnaire, you mentioned that you use [computer tool] quite regularly with people of different cultural backgrounds. What kinds of nationalities of people do you frequently communicate with over computer tools?

If you think back to a recent conversation you had (using computer tools) with someone from a different cultural background, did you notice any differences or anything surprising in how they communicated with you?

Has there ever been a time a miscommunication occurred, with someone from a different cultural background when you were using [computer tool]? E.g. you intended one meaning, but they interpreted it in a different way?

- How did it happen?
- Why did it happen?
- What did *you* originally mean? How did they interpret it?
- How/When did you realize the miscommunication?
- Did you adapt your behavior afterwards?

What do you think are the challenges (if any) when using [computer tool] with someone from a different cultural background?

What do you think are the advantages (if any) when using [computer tool] with someone from a different cultural background?

When you communicate with someone from a different cultural background, do you have any strategies for avoiding miscommunication?

When communicating with someone from a different cultural background:

- Has there ever been a time where you started using one computer tool, but then decided to switch to another? (Who / when/ why?)

- Has there ever been a time where you used multiple computer tools at the same time?

UNSPOKEN RULES OVER CMC

Do you feel like there any unspoken roles with how people use Email for communication? For example, how to greet people, who you include in the CC list, etc?

Do you interact differently when chatting with someone over FTF compared to video chat? What about FTF compared to phone?

Do you think are the differences when you compare using email versus using Instant Messaging?

When and how did you first become aware of these unspoken rules?

After you became aware of these unspoken rules, did you adapt how you used [computer tool] in any ways?

Do you think the unspoken rules are the same or different when communicating with someone from a different cultural background?

EMAIL AND INSTANT MESSAGING:

- Conversation initiation
- Addresses and greetings
- Capitalization / grammar
- Formality
- Non-verbal
    - Tone of message?

    - Feeling words
    - Emoticons
    - Time:
        - Time of day when message was sent / replied to
        - Turn-taking (amount of time in between messages)
        - Silence
- Farewells
- Social versus task content

EMAIL ONLY:
- Subject?
- To recipients list, in any particular order? Cc / bcc?
- Manage inbox?
- Response times? Response etiquette?
- Forwarding behaviors? Trust?
- How do you know when conversation is done? (no response required?)

VIDEO CHAT:
- Conversation initiation
- Greetings
- Nonverbal communication
    - Eye contact
        - Where do you look on the screen?
        - At yourself? At others?
    - Gestures
    - Voice inflections
    - Voice loudness
    - Proxemics (how close they sit to the camera)
    - Turn-taking and silence
- Formality
- Farewells

HARDWARE

What kinds of devices do you usually communicate with your work colleagues on? (e.g. computer, smartphone, etc?)
- Does the device you use affect how you write your message? (encoding)
- Does the device you use affect how you interpret someone else's message? (decoding)

LAST THOUGHTS

Anything you wished you would have known about how to use CMC in the workplace that you didn't know before?
- With people of the same culture?
- With people of different cultures?

2-sided interviews?

Other stories to share?

Appendix C. Investigating feedback interventions in global virtual teams

This appendix presents materials used for the study on investigating feedback interventions in global virtual teams [Chapter 8].

a) Study recruitment - Canadians

****** CALL FOR PARTICIPANTS! *******
MAKE $100 IN A STUDY EXPLORING EMAIL COMMUNICATION STYLES

WHO:

- Undergraduate students between ages 18-30.
- You must be born and raised in Canada.
- You should not have lived outside of Canada for more than 1 year.

COMPENSATION: To thank you for your time, you will be compensated $100 (CAD).

WHAT: We are conducting a study to explore how Email tools can support different communication styles. All collected data will be anonymized and used strictly for research purposes. We ask you to:

1. Do a decision-making task with an (assigned) partner located in Japan, using Email.
2. Write ~6 Emails to your partner, to be completed within a 3-day period.
3. Fill out questionnaires about your demographic information and your experience with the task.
4. Over Skype, discuss your experiences with a researcher after the task.

WHEN: The study will take between 2 to 3.5 hours in total.

- Steps 1,2,3 above will take place over Email, between December 6 - 8, 2016.
- Step 4 will be completed over Skype. This will take ~30-minutes and will occur sometime between December 9 - 14 (depending on your availability).

HOW TO PARTICIPATE: Please fill out a 3-minute demographic questionnaire. You will be contacted by a researcher from the University of Zurich to confirm your participation. https://www.surveymonkey.com/r/LQBJ5QM

Questions or concerns?
Contact person: Helen Ai He, PhD Candidate
Email: helen.he@ifi.uzh.ch, Phone: 0041 767858823
Website: www.helenaihe.com
People and Computing Lab, Department of Informatics. University of Zürich, Switzerland

b) Study recruitment – Japanese

******日本人の実験参加者、大募集! *******

WHO:

- Undergraduate students between ages 18-30.
- You must be born and raised in Japan.
- You should not have lived outside of Japan for more than 1 year.
- Feel comfortable when writing in English (in Email). (No spoken English required).

COMPENSATION: To thank you for your time, you will be compensated ¥10000.

WHAT: We are conducting a study to explore how Email tools can support different communication styles. All collected data will be anonymized and used strictly for research purposes. We ask you to:

5. Do a decision-making task with an (assigned) partner located in Canada, using Email.
6. Write a minimum of 6 Emails in total to your partner, within 3 days (between December 6-8).
7. Fill in questionnaires about your demographic information and your experience with the task.
8. After the task, discuss your experiences with a researcher (in Japanese) over Skype.

WHEN: The study will take between 2 to 3.5 hours in total.

- Steps 1,2,3 above will take place over Email (you can join from anywhere!), between December 6 - 8, 2016.
- Step 4 will be completed over Skype (you can join from anywhere!). This will take approximately 30 minutes and will occur sometime between December 9 - 14 (depending on your availability).

HOW TO PARTICIPATE: Please fill out a 3-minute demographic questionnaire. You will be contacted by a researcher from the University of Zurich to confirm your participation. https://www.surveymonkey.com/r/36LDQWX

QUESTIONS OR CONCERNS? Please contact Helen Ai He at the University of Zurich, Email: helen.he@ifi.uzh.ch.

PRIVACY AND CONFIDENTIALITY: Please note that the interview will be audio-taped. The data will be strictly undisclosed and will be used exclusively for research. All your private information (e.g. name, audio data) will be strictly undisclosed and will not appear anywhere (including reports and presentations of this study). Your data will be anonymized and you will be identified only by a participant number (e.g. P12).

RISKS AND DISCOMFORT: There are no obvious physical, legal or economic risks associated with participating in this study. However, you will be asked questions about yourself and these questions may sometimes make you uncomfortable. You can refuse to answer any questions that you do not wish to answer during the interview, with no penalty, and no effect on the compensation earned before withdrawing.

PARTICIPATION IS VOLUNTARY: Your participation in this study is voluntary. Your participation has no effect on your relationship with any organization or service that may be involved in this research.

c) Consent form - Canadians

Consent Form

In today's globalized world, we often interact with **people from different cultures**. In this study, we wish to explore how email tools can support communication between people from different cultural backgrounds.

What will I be asked to do?

We will ask you to complete a decision-making task with a partner from Japan over email. You will be assigned to one of three experimental conditions – you will not know which condition you are in. In all conditions, you will be asked to:

1) Complete a decision-making task with a partner over email.
    a. Your partner lives in Japan. You will only communicate through email, using English.
    b. You will write a minimum of 4 emails to your partner, to be completed within a 6-day period.
    c. You and your partner's emails will be analyzed by a text analysis tool. Depending on which experimental condition you are in, you will be shown the results of this text analysis during your email conversation.
2) Before, during and after the study: Fill out questionnaires about your demographic information and your experience with the task.
3) After the task is complete: Discuss your experiences with a researcher. This discussion will take place over Skype and will last for ~30 minutes. We are interested in hearing about your personal experiences (e.g. how you felt, what you learned (if anything)) during the task.

What information will be collected?

Data collection will include all questionnaire data (e.g. demographic information, experiences with the task), the email conversation between you and your partner, and an audio-recording of your Skype call.

Will this information be confidential?

Your participation in this study is voluntary. All collected data is used strictly for research purposes. All collected data will be anonymized – this means any personally identifying information will be removed. In written publications or oral presentations based on this research, you will be identified only by a participant number (e.g. P12).

All data (emails, audio recordings) will be saved on password-protected devices or locked in university filing cabinets at the University of Zurich. They will be stored for a maximum period of 5 years, after which they will be deleted permanently.

Are there benefits to participating?

To thank you for your time, you will be compensated 100 CAD. After the study, if you are interested in your research results, we will be happy to keep you informed.

Are there risks to participating?

There is no risk to participate in this study, beyond the risks associated with normal everyday activity. You are free to withdraw your participation at any point during the study. However, unless you request otherwise, any information you contribute up to the point at which you choose to withdraw will be retained and may be used in the study.

Are there benefits to participating?

To thank you for your time, you will be compensated 100 CAD. After the study, if you are interested in your research results, we will be happy to keep you informed.

Are there risks to participating?

There is no risk to participate in this study, beyond the risks associated with normal everyday activity. You are free to withdraw your participation at any point during the study. However, unless you request otherwise, any information you contribute up to the point at which you choose to withdraw will be retained and may be used in the study.

Consent

By signing this form, you confirm the following statements:

- A researcher explained the study and the listed conditions to me.
- I had the opportunity to ask questions.
- I understood the answers and accept them.
- I am at least 18 years old.
- I had enough time to make the decision to participate.
- I agree to the participation.

In no way does signing this form waive your legal rights or release the investigators or involved institutions from their legal or professional responsibilities. You are free to withdraw from this research project at any time. Please feel free to ask for clarification or new information at any time during your participation.

Participant's name (please print)	Researcher's name (please print)
Location and date	Location and date
Participant's signature	Researcher's signature

d) Consent form - Japanese

同意書

世界のグローバル化により、多様な文化を持つ人々と交流する機会が増加しています。このような時代背景を踏まえ、本研究は、多様な文化背景を持つ人々のコミュニケーションを支援することを目的としています。特に、電子メールを用いて異文化間コミュニケーションを支援する方法について検討しています。

実験内容について

実験内容の概要は以下の通りです。実験手順や具体的な課題の内容は、実験者から別途送付します。

4) 電子メールを用いてカナダ人のパートナーと意思決定課題に取り組んで頂きます。
（パートナーについても、近々、実験者からメールで紹介します。）
   a. カナダ人のパートナーとのメールのやり取りは、英語を用いて行って下さい。
   b. 意思決定課題は、6 日以内に終了して下さい。また、この間、最低でも 4 通の電子メールをパートナーに送って下さい。
   c. あなたとあなたのパートナーの電子メールは、テキスト分析ツールによって分析され、その分析結果がフィードバックされます。
5) 意思決定課題の前後に、アンケートにお答え頂きます。
6) 意思決定課題を終了した後，後日、インタビューを実施させて頂きます。インタビューは 30 分程度、Skype 越しに日本語で行います。インタビューでは、意思決定課題を通してあなたが感じたことや気づいた点などについてお話を伺いたいと思っています。

実験中に収集する情報について

本実験で収集するデータは、以下の通りです。
・アンケートでお答え頂く内容（基本情報、課題での体験について問う質問など）
・あなたとあなたのパートナーが電子メールでやり取りする内容
・Skype 越しのインタビューの音声記録

収集した情報の利用方法について

収集したデータはすべて、研究の目的のためだけに使用されます。収集データはすべて匿名化されます（つまり、個人を特定する情報はすべて削除されます）。本研究の成果を出版・発表において、各個人のインタビュー内容などを掲載する際、P12 といった風に参加者番号によって報告します。

本同意書は、パスワード保護されたデバイスに保存の上、チューリッヒ大学の大学書類棚に施錠保管されます。データは最大 5 年間保存され、その後は永久的に消去されます。

本実験に参加することのメリットについて

時間を割いていただいたお礼として、10,000円が後日NTTの研究所より支払われます。研究結果にご興味があるようでしたら、実験者にお知らせ下さい。本研究の成果が出た際にお知らせいたします。

本実験の参加に伴うリスクについて

本研究への参加は任意です。本研究に参加するリスクはありません。あなたは、本研究のどの時点でも自由に参加を取り止めることができます。

同意

本同意書に署名することにより、あなたは以下の事項に承知したことになります。
- 私は、同意書の内容を理解し、同意書の条件に同意します。
- 私の年齢は 18 歳以上です。

本同意書への署名は、あなたの法的な権利を放棄したり、調査者や関連する機関の法律上または専門職としての責任を免除したりするものでは決してありません。

_____

参加者の氏名（活字体でお願いします）　　**研究者氏名**

_____

参加者の電子メール　　**研究者の所在地および日付**
（カナダのパートナーとのコミュニケーションに使う
電子メールアドレスを記載して下さい）

_____

参加者の所在地および日付　　**研究者の署名**

_____

参加者の署名

お問い合わせ先
私たちの研究、または本研究への参加に関して質問がございましたら以下までご連絡ください。

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e) Cognitive conflict negotiation task

YOUR TASK: ASSIGNING LIMITED FUNDS TO SOCIAL PROGRAMS

You and your email partner are the financial advisors of a global philanthropic organization, called "Envision Change International" (ECI). This organization has offices around the world and has received recognition for its important contributions to addressing global issues.

ECI has to assign $1.8 million ($1,800,000) to finance social programs for 2017. Five program proposals are vigorously competing for these funds. (See page 2 for the list of program proposals).

The director of ECI has asked you and your partner to jointly decide which program proposals to fund. The partner in Japan is the financial advisor of the Japanese headquarters. The partner in Canada is the financial advisor of the Canadian headquarters. Both of you have the same status and decision-making power within ECI.

The director has two requirements:

1) A program needs (at least) $0.5 million ($500,000) in order to be effective.
2) At least *one* of the five programs needs to be funded (a minimum) of $1 million.

While all five programs (listed on page 2) are important, the director has asked you and your partner to select programs that you personally believe are worthy of funding in terms of addressing social issues.

The director asked you to follow this procedure:

1) On your own, fill in this questionnaire (https://www.surveymonkey.com/r/JXFR2TH) for how YOU wish to allocate the $1.8 million – your decision should be based on your personal beliefs.
2) Communicate your decision to your partner over email. Your goal is to CONVINCE YOUR PARTNER that your proposal (decided in Step 1) is the best option.
    a. To convince your partner, you can use personal experiences or stories – there is no need to do any research on these topics.
3) By the end of the task, you and your partner should come to an agreement of fund allocation that you are both happy with.

TIMELINE:

- The task must be completed between December 2 – 6, 2016.
    - The deadline to finish is December 6, 23:59 GMT (Canada), which is December 7 08:59 JST (Japan).
    - If you and your partner wish to finish earlier, you are welcome to do so!

EMAIL REQUIREMENTS:

- You must write a minimum of 4 emails (in total) to your partner. (You are welcome to write more than 4 emails, but it is not required. Your 5th email onwards will be ignored for text analysis).
- Each email should include 1-2 paragraphs. (This requirement is to ensure the text analysis program has enough text to analyze).
- Due to the large time zone difference between Japan and Canada, please write at least one email per day (to finish the task on time).
- All emails should be in English.
- Since this study explores personal communication styles in email, your emails should only contain your OWN writing. Please:
    - Do NOT copy and paste content from external sources into your email
    - Do NOT attach photos, images, attachments, or links.
    - You can quote text from your partner's email if needed, but try to keep this to a minimum.
    - Japanese participants: You may use translation tools, but please do not copy and paste large amounts of translated text into your email.

- ***IMPORTANT: Every time you write an email to your partner, please CC this email uniexperiment2016@gmail.com. (This gives us access to your emails).

What happens if we finish the task, before we reach 4 emails?
In the rare case this happens, please allocate another $1.8 million to two different social programs on the list, following the same steps and requirements on page 1. Your discussions will inform the ECI Director's decisions for program funding in 2018.

LIST OF PROGRAM PROPOSALS
If a program is selected, funding will be split EQUALLY between Japan and Canada.

PROGRAM: Prevention and punishment for high-school bullying
If selected, funding will support both the prevention and punishment for high-school bullying. Prevention measures will include mental health counseling for students and their families, awareness campaigns, and community outreach programs. Punishment measures will promote the establishment of stricter laws against high-school bullying.

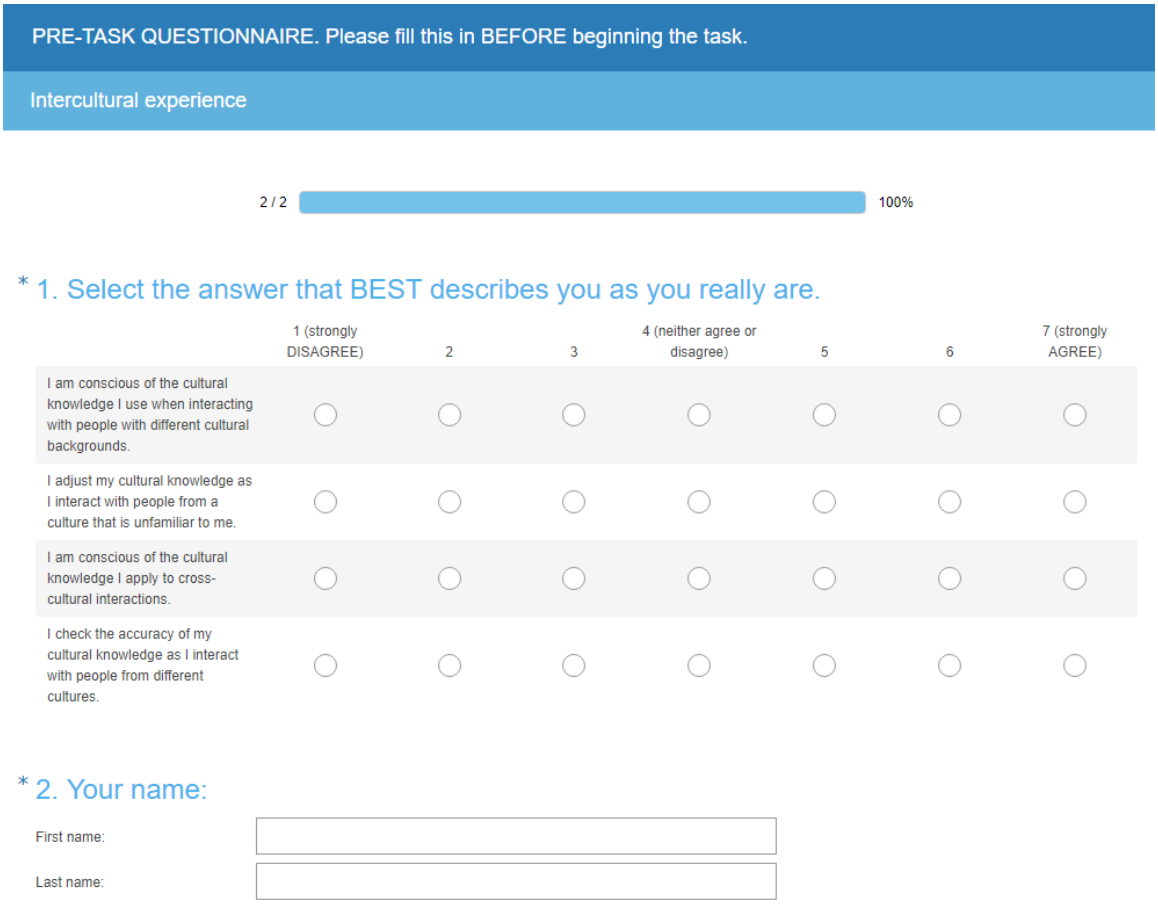
PROGRAM: Regulations about workplace overtime
If selected, funding will be used to improve current regulations regarding workplace overtime, national awareness campaigns, training programs for leaders about the dangers of overwork, and mental health counseling for company employees.

PROGRAM: Rehabilitation programs for drug addiction
If selected, funding will support the establishment of rehabilitation centers for drug addiction. Such centers will offer detoxification programs, mental and physical health programs, as well as the training of life skills and employment skills.

PROGRAM: Integration of immigrants and refugees
If selected, funding will support the integration of new immigrants and refugees, from various countries around the world. Support will be offered in the form of language classes, training on the cultural customs of the host country, and employment offices to help immigrants and refugees find work.

PROGRAM: Robots to take care of the elderly
If selected, funding will support academic research on robots to take care of the elderly. This is a new and emerging topic – therefore, funding go towards research to explore the elderly's experiences and attitudes towards such robots, and how they could be improved to provide better care in the future.

f) Pre-task questionnaire (Metacognitive CQ)



PRE-TASK QUESTIONNAIRE. Please fill this in BEFORE beginning the task.

Intercultural experience

2 / 2 100%

* 1. Select the answer that BEST describes you as you really are.

	1 (strongly DISAGREE)	2	3	4 (neither agree or disagree)	5	6	7 (strongly AGREE)
I am conscious of the cultural knowledge I use when interacting with people with different cultural backgrounds.	○	○	○	○	○	○	○
I adjust my cultural knowledge as I interact with people from a culture that is unfamiliar to me.	○	○	○	○	○	○	○
I am conscious of the cultural knowledge I apply to cross-cultural interactions.	○	○	○	○	○	○	○
I check the accuracy of my cultural knowledge as I interact with people from different cultures.	○	○	○	○	○	○	○

* 2. Your name:

First name:

Last name:

g) Post-task questionnaire (Metacognitive CQ)

POST-TASK QUESTIONNAIRE. Please complete after you have finished the task.

Intercultural Experience

* 1. Select the answer that BEST describes you as you really are.

	1 (strongly DISAGREE)	2	3	4 (neither agree or disagree)	5	6	7 (strongly AGREE)
I am conscious of the cultural knowledge I use when interacting with people with different cultural backgrounds.	○	○	○	○	○	○	○
I adjust my cultural knowledge as I interact with people from a culture that is unfamiliar to me.	○	○	○	○	○	○	○
I am conscious of the cultural knowledge I apply to cross-cultural interactions.	○	○	○	○	○	○	○
I check the accuracy of my cultural knowledge as I interact with people from different cultures.	○	○	○	○	○	○	○

* 2. During the experiment, what (if anything) did you learn about **YOURSELF** or your **OWN culture**? How did you learn this? Please explain briefly.

* 3. During the experiment, what (if anything) did you learn about your **PARTNER** or **THEIR culture**? How did you learn this? Please explain briefly.

* 4. During the experiment, **did you ADJUST** how you wrote to your partner? If so, **how** did you adjust and **why?** Please explain briefly.

* 5. During the experiment, do you think your partner **ADJUSTED** how they wrote to you? If so, **how** did they adjust and **why?** Please explain briefly.

h) Semi-structured interviews – Condition 1 (no feedback)

Experience with the task:

- What was your experience with/ How did you find the task?

Experience with partner:

- What was your experience working with your partner?
- Was there anything that you found particularly challenging or difficult when communicating with your partner? Please explain.
- Was there anything that you found particularly interesting or surprising when communicating with your partner? Please explain.

Reflection and Learning about own culture or other's culture:

- Did you learn anything about yourself or your own culture? If so, how did you learn this?
- Did you learn anything about your partner or their culture? If so, how did you learn this?

Behavior adaptation in the beginning vs. end of communication:

- If you compare the first two emails YOU WROTE to your partner, with the last two emails YOU WROTE to your partner, did you adapt somehow? Please explain.
- If you compare the first two emails YOUR PARTNER wrote to you, with the last two emails YOUR PARTNER wrote to you, did to adapt somehow? Please explain.

i) Semi-structured interviews – Condition 2 (graphs)

In addition to the questions asked in Condition 1 (no feedback), participants were also asked the questions below:

ROUND 1 - GRAPHS

- When you saw the first round of graphs, what were your impressions?
- What did you think about the descriptions beside each graph?
- Was there anything particularly interesting or surprising about the graphs? Talk about each graph.
- Talk about own graph data
- Talk about partner's graph data

AFTER GRAPHS ROUND 1

- Did you try to adapt somehow, after seeing the graphs in Round 1? If so, how?

ROUND 2- GRAPHS

- When you saw the second round of graphs, what were your impressions?
- Was there anything particularly interesting or surprising about the graphs?
- What about when you compared….
    - Your own data with your partner's data?

j) Semi-structured interviews – Condition 3 (graphs + self-reflections)

In addition to the questions asked in Condition 1 (no feedback) and Condition 2 (graphs), participants were also asked the questions below:

ROUND 1 - REFLECTION

After you saw the graphs, you filled in some questionnaires asking you to reflect on your own data, and your partner's data.

When you read your partner's reflection about their own data:

- Did you learn anything about yourself or Japanese culture? If so, how did you learn this?
- Did you learn anything about your partner or Canadian culture? If so, how did you learn this?

AFTER GRAPHS ROUND 1

- Did you try to adapt somehow, after seeing the graphs in Round 1? If so, how?

ROUND 2- GRAPHS

- When you saw the second round of graphs, what were your impressions?
- Was there anything particularly interesting or surprising about the graphs?
- What about when you compared….
    - Your own data with your partner's data?
    - your own data with the average Japanese data?
    - your partner's data with the average Canadian data?
- If you compare the first and second round of graphs, did you notice anything interesting or surprising for you?

ROUND 2 - REFLECTION

After you saw the second round of graphs, you filled in some questionnaires asking you to reflect on your own data, and your partner's data.

When you read your partner's reflection about their own data:

- Did you learn anything about yourself or Japanese culture? If so, how did you learn this?
- Did you learn anything about your partner or Canadian culture? If so, how did you learn this?

Appendix D. Curriculum Vitae

Education

2012 - present	**PhD candidate**
	Dept. of Informatics, University of Zurich, Switzerland.
2007 - 2010	**Master of Science**
	Computer Science, University of Calgary, Canada.
2002 - 2007	**Bachelor of Science**
	Computer Science, Internship program, Concentration in Computer Graphics. University of Calgary, Canada

Work experience

01-04.2016	**Research Intern**
	NTT Communication Science Labs, Kyoto, Japan.
2010 - 2012	**Software Developer**
	SMART Technologies, Calgary, Canada.
2005 - 2006	**Quality Assurance Assistant**
	Internship program. Computer Modeling Group Ltd. Calgary, Canada